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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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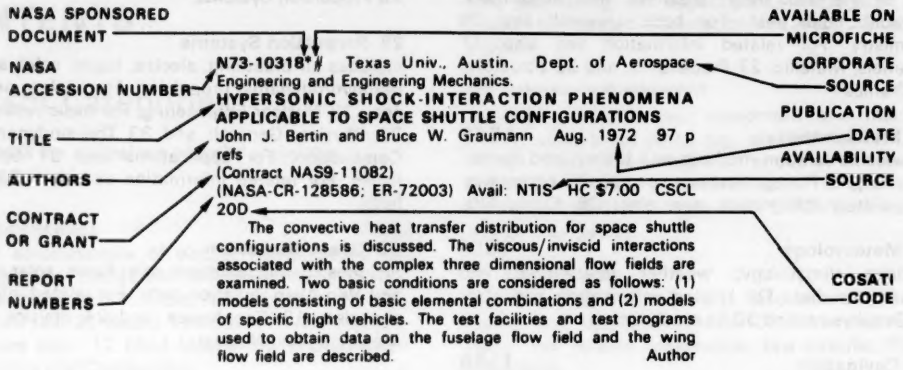
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REPORT NUMBERS
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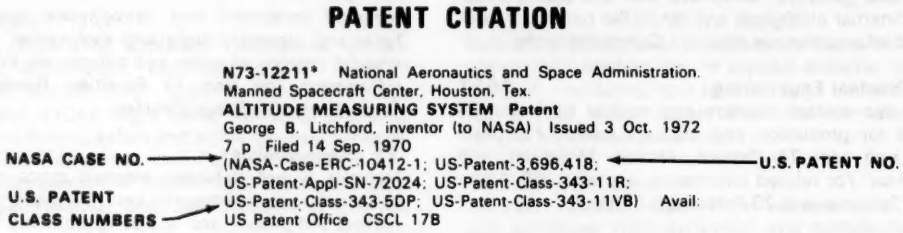
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

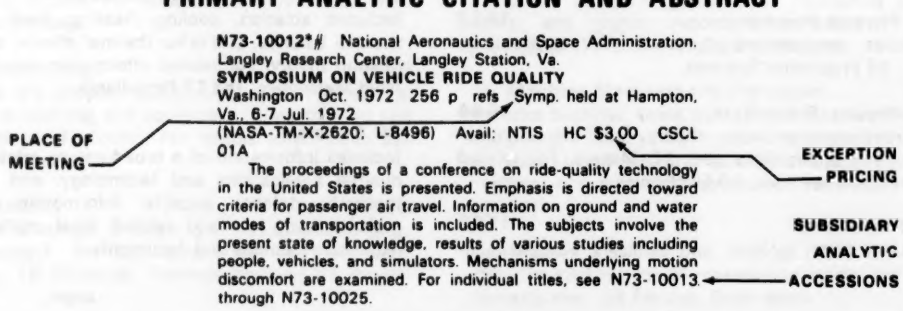
PATENT CITATION


N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
NASA CASE NO.
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B
U.S. PATENT NO.
U.S. PATENT CLASS NUMBERS

PATENT APPLICATION CITATION

N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
U.S. PATENT APPLICATION SERIAL NO.
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT


N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
PLACE OF MEETING
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A
EXCEPTION PRICING
The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.
SUBSIDIARY ANALYTIC ACCESSIONS

SUBSIDIARY ANALYTIC CITATION

PRIMARY ANALYTIC ACCESSION AND LOCATION OF FULL CITATION AND ABSTRACT
N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02) CSCL 01A
PAGES IN PRIMARY REPORT

VOLUME 11 NUMBER 13 / JULY 8, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-21895*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 28, FEBRUARY 1973
Feb. 1973 95 p refs
(NASA-SP-7037(28)) Avail: NTIS HC $3.00 CSCL 01A

This special bibliography lists 308 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1972. Author

N73-21896*# Kansas Univ., Lawrence.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q-STABILITY DERIVATIVES
Jan Roskam and C. Lan Washington NASA Apr. 1973 106 p refs
(Grant NGR-17-002-071)
(NASA-CR-2117; CRES-FRL-72-002) Avail: NTIS HC $3.00 CSCL 01A

Summarized are the aerodynamic center, alpha and q-aeroelastic effects on fighter-type aircraft in the 18,700 N gross range. The results indicate that with proper tailoring of planform (fixed or variable sweep), stiffner and elastic axis location it is possible to minimize trim requirements between selected extreme conditions. The inertial effects were found to be small for this class of aircraft. Author

N73-21897*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q- STABILITY DERIVATIVES. APPENDIX A: A COMPUTER PROGRAM FOR CALCULATING ALPHA- AND q- STABILITY DERIVATIVES AND INDUCED DRAG FOR THIN ELASTIC AEROPLANES AT SUBSONIC AND SUPERSONIC SPEEDS
J. Roskam, C. Lan, and S. Mehrotra Oct. 1972 175 p
(Grant NGR-17-002-071)
(NASA-CR-112229; CRINC-FRL-72-011-App-A) Avail: NTIS HC $10.75 CSCL 01A

The computer program used to determine the rigid and elastic stability derivatives presented in the summary report is listed in this appendix along with instructions for its use, sample input data and answers. This program represents the airplane at subsonic and supersonic speeds as (a) thin surface(s) (without dihedral) composed of discrete panels of constant pressure according to the method of Woodward for the aerodynamic effects and slender beam(s) for the structural effects. Given a set of input data, the computer program calculates an aerodynamic influence coefficient matrix and a structural influence coefficient matrix. Author

N73-21898*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q- STABILITY DERIVATURES. APPENDIX B: METHOD FOR COMPUTING THE STRUCTURAL INFLUENCE COEFFICIENT MATRIX OF NONPLANAR WING BODY TAIL CONFIGURATIONS
J. Roskam, H. Smith, and G. Gibson Oct. 1972 29 p refs
(Grant NGR-17-002-071)
(NASA-CR-112230; CRINC-FRL-72-012-App-B) Avail: NTIS HC $3.50 CSCL 01A

The method used in computing the structural influence coefficient matrix of the computer program of Reference 1 (appendix A of the Summary Report) is reported. This matrix is computed for complete wing-body-tail configurations by assuming that all major airplane components can be structurally represented by a slender beam called the elastic axis. A structural influence coefficient is defined as the rotation about the Y-stability axis at panel j induced by a unit load on panel k. A description of how a structural breakdown is performed in detail is included. Author

N73-21899*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q- STABILITY DERIVATIVES. APPENDIX C: METHOD FOR COMPUTING THE AERODYNAMIC INFLUENCE COEFFICIENT MATRIX OF NONPLANAR WING-BODY-TAIL CONFIGURATIONS
J. Roskam Oct. 1972 32 p refs
(Grant NGR-17-002-071)
(NASA-CR-112231; CRINC-FRL-72-013-App-C) Avail: NTIS HC $3.75 CSCL 01A

Expressions are derived for computing the aerodynamic influence coefficient matrix for nonplanar wing-body-tail configurations. An aerodynamic influence coefficient is defined as the load in lbs. induced on a panel as a result of a unit angle of attack on another panel. Fuselage, wing and tail thickness are assumed to be small with the result that the thickness effect on the flow-field is negligible. The method for determining the aerodynamic influence coefficient matrix is based on the lifting solution to the small perturbation, steady potential flow equation. Author

N73-21900*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q- STABILITY DERIVATIVES. APPENDIX D: PROCEDURES USED TO DETERMINE THE MASS DISTRIBUTION FOR IDEALIZED LOW ASPECT RATIO TWO SPAR FIGHTER WINGS
J. Roskam, F. R. Hamler, and D. Reynolds Oct. 1972 15 p refs
(Grant NGR-17-002-071)
(NASA-CR-112232; CRINC-FRL-72-014-App-D) Avail: NTIS HC $3.00 CSCL 01A

The procedures used to establish the mass matrices characteristics for the fighter type wings studied are given. A

description of the procedure used to find the mass associated with a specific aerodynamic panel is presented and some examples of the application of the procedure are included. Author

N73-21901*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, alpha- AND q-STABILITY DERIVATIVES. APPENDIX E: PROCEDURES USED TO DETERMINE THE STRUCTURAL REPRESENTATION FOR IDEALIZED LOW ASPECT RATIO TWO SPAR FIGHTER WINGS
J. Roskam, C. Lan, H. Smith, and G. Gibson Oct. 1972 18 p refs
(Grant NGR-17-002-071)
(NASA-CR-112233; CRINC-FRL-72-015-App-E) Avail: NTIS HC $3.00 CSCL 01A

An explanation is presented of the method used to locate the elastic axis and the method to determine the EI and GJ distributions along the elastic axes of wings with a 2-spar (front and rear) construction or a single torque-box construction. Author

N73-21902# Weapons Research Establishment, Salisbury (Australia).
THE ESTIMATION OF VISCOUS NORMAL FORCE, PITCHING MOMENT, SIDE FORCE AND YAWING MOMENT ON BODIES OF REVOLUTION AT INCIDENCES UP TO 90 DEG
K. D. Thomson Oct. 1972 85 p refs
(WRE-782(WR/D)) Avail: NTIS HC $6.25

Wind tunnel tests to determine the viscous normal force, pitching moment, side force, and yawing moment on bodies of revolution at incidences up to 90 degrees were conducted. Semi-empirical methods based on an adaptation of the impulse flow analogy are derived for estimating the distribution of cross flow drag and the viscous forces and moments. Three different types of flow field are identified as the incidence is increased from 0 to 90 degrees and a method for predicting the viscous normal force and pitching moment in each field is presented. Two methods are given for estimating extreme values of the side force and yawing moment which arise from asymmetric vortex shedding. Author

N73-21903# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
LOW SPEED WIND TUNNEL MEASUREMENTS OF THE OSCILLATORY LONGITUDINAL DERIVATIVES OF A DELTA WING OF ASPECT RATIO 0.8
R. K. Cooper Dec. 1971 35 p refs
(ATN-7105) Avail: NTIS HC $3.75

The oscillatory longitudinal derivatives of a thin delta wing with 0.8 aspect ratio were measured over a range of incidence, frequency of oscillation, and wind speed. Some variation of the derivatives with frequency was found, but this was of secondary importance compared with the variation of incidence. Reynolds' number effects were found to be significant but these were suppressed as far as possible by the use of boundary layer trip wires. Fair agreement between the oscillatory results and derivatives calculated from steady flow tests was obtained. Author

N73-21904*# Bell Aerospace Co., Buffalo, N.Y.
FINITE ELEMENT APPROACH TO THE INTEGRATED POTENTIAL FORMULATION OF GENERAL UNSTEADY SUPERSONIC AERODYNAMICS
Kari Appa and G. C. C. Smith [1973] 38 p refs
(Contract NAS1-10880)
(NASA-CR-112296) Avail: NTIS HC $4.00 CSCL 01A

Analytical formulation of the integrated potential approach for general unsteady supersonic configurations is related to numerical solution approaches using an arbitrary finite element mesh. Work remains to be done on adequate numerical handling of singular integrals, discussed in an appendix. Limited results on a planar rectangular wing are presented. Author

N73-21905*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INVESTIGATION OF FLOW FIELDS WITHIN LARGE SCALE HYPERSONIC INLET MODELS
A. Vernon Gnos, Earl C. Watson, William R. Seebaugh (Fairchild Ind., Inc., Farmingdale, N. Y.), Robert J. Sanator (Fairchild Ind., Inc., Farmingdale, N. Y.), and Joseph P. DeCarlo (Fairchild Ind., Inc., Farmingdale, N. Y.) Washington Apr. 1973 175 p refs (Contracts NAS2-5052; NAS2-5719)
(NASA-TN-D-7150; A-4274) Avail: NTIS HC $3.00 CSCL 01A

Analytical and experimental investigations were conducted to determine the internal flow characteristics in model passages representative of hypersonic inlets for use at Mach numbers to about 12. The passages were large enough to permit measurements to be made in both the core flow and boundary layers. The analytical techniques for designing the internal contours and predicting the internal flow-field development accounted for coupling between the boundary layers and inviscid flow fields by means of a displacement-thickness correction. Three large-scale inlet models, each having a different internal compression ratio, were designed to provide high internal performance with an approximately uniform static-pressure distribution at the throat station. The models were tested in the Ames 3.5-Foot Hypersonic Wind Tunnel at a nominal free-stream Mach number of 7.4 and a unit free-stream Reynolds number of 8.86 X one million per meter. Author

N73-21906*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC WIND-TUNNEL TESTS OF A TRAILING-CONE DEVICE FOR CALIBRATING AIRCRAFT STATIC PRESSURE SYSTEMS
Frank L. Jordan, Jr. and Virgil S. Ritchie Washington May 1973 25 p refs
(NASA-TN-D-7217; L-8672) Avail: NTIS HC $3.00 CSCL 01C

A trailing-cone device for calibrating aircraft static-pressure systems was tested in a transonic wind tunnel to investigate the pressure-sensing characteristics of the device including effects of several configuration changes. The tests were conducted at Mach numbers from 0.30 to 0.95 with Reynolds numbers from (0.9 x one million to 4.1 x one million per foot). The results of these tests indicated that the pressures sensed by the device changed slightly but consistently as the distance between the device pressure orifices and cone was varied from 4 to 10 cone diameters. Differences between such device-indicated pressures and free-stream static pressure were small, however, and corresponded to Mach number differences of less than 0.001 for device configurations with pressure orifices located 5 or 6 cone diameters ahead of the cone. Differences between device-indicated and free-stream static pressures were not greatly influenced by a protection skid at the downstream end of the pressure tube of the device nor by a 2-to-1 change in test Reynolds number. Author

N73-21907*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND TUNNEL INVESTIGATION OF A SEMISPAN STOL JET TRANSPORT WING BODY WITH AN UPPER SURFACE BLOWN JET FLAP
Arthur E. Phelps, William Letko, and Robert L. Henderson Washington May 1973 41 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Fort Eustis, Va.
(NASA-TN-D-7183; L-8740) Avail: NTIS HC $3.00 CSCL 01A

An investigation of the static longitudinal aerodynamic characteristics of a semispan STOL jet transport wing-body with an upper-surface blown jet flap for lift augmentation was conducted in a low-speed wind tunnel having a 12-ft octagonal test section. The semispan swept wing had an aspect ratio of 3.92 (7.84 for the full span) and had two simulated turbofan engines mounted ahead of and above the wing in a siamese pod equipped with an exhaust deflector. The purpose of the deflector was to spread the engine exhaust into a jet sheet attached to the upper surface of the wing so that it would turn downward over the flap and provide lift augmentation. The wing also had optional boundary-layer control provided by air blowing through a thin slot over a full-span plain trailing-edge flap. Author

N73-21908# Royal Aircraft Establishment, Teddington (England). Aerodynamics Dept.
THEORETICAL CALCULATION OF GENERALIZED FORCES AND LOAD DISTRIBUTION ON WINGS OSCILLATING AT GENERAL FREQUENCY IN A SUBSONIC STREAM
Doris E. Lehrian and H. C. Garner London Aeron. Res. Council 1973 73 p refs Supersedes RAE-TR-71147; ARC-33405 (ARC-R/M-3710; RAE-TR-71147; ARC-33405) Avail: NTIS HC $5.75; HMSO £2.65; PHI $10.40

A new linear theoretical method is developed to give improved accuracy and economy of operation on a KDF9 computer. The program covers the special cases of zero and very small frequency. It is general in planform and mode of oscillation, provided that these are smooth, and has no serious restrictions on chordwise or spanwise terms. The method is applied to elliptical, rectangular and tapered swept wings of small and large aspect ratio at Mach numbers up to 0.8; calculations cover a wide range of frequency parameter. Numerous independent checks on accuracy are included as well as studies of convergence and comparisons with current methods. Author (ESRO)

N73-21909# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Dept. of Dynamics and Computation.
SOME TEST CASES BASED ON ANALYTICAL METHODS IN LINEARIZED SUPERSONIC OSCILLATING LIFTING SURFACE THEORY, INTRODUCTION AND PART 1
A. J. L. R. Hasekamp 1 Nov. 1972 77 p
(FOK-X-449-Pt-1) Avail: NTIS HC $6.00

With the aid of five ALGOL 60 procedures, the velocity potential and pressure distribution on three types of planforms oscillating harmonically in a supersonic mainstream can be calculated. The three types of planforms considered are: a rectangular planform, a triangular planform with supersonic leading edges, and a triangular planform with subsonic leading edges. Part 1 of the report is a user's guide to the five procedures, while Part 2 gives the derivation of the formulas from which the procedures have been programmed. ESRO

N73-21910# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Dept. of Dynamics and Computation.
SOME TEST CASES BASED ON ANALYTICAL METHODS IN LINEARIZED SUPERSONIC OSCILLATING LIFTING SURFACE THEORY, PART 2
A. J. L. R. Hasekamp 1 Nov. 1972 270 p refs
(FOK-X-449-Pt-2) Avail: NTIS HC $15.50
For abstract, see N73-21909.

N73-21911# Oxford Univ. (England). Dept. of Engineering Science.
THE EFFECT OF A BEVELLED TRAILING EDGE ON VORTEX SHEDDING AND VIBRATION
M. E. Greenway and C. J. Wood 1973 30 p refs Sponsored by Ministry of Defence
(Rept-1052/73) Avail: NTIS HC $3.50

Flow induced vibrations of airfoils are associated with the presence of a blunt trailing edge which sheds an alternating trail of vortices into the wake. This shedding is associated with periodic fluctuations in circulation about the body and the corresponding fluctuations in the lift distribution are responsible for the excitation of various modes of structural or other vibration. Research has led to a growth of empirical knowledge about trailing edge shapes which are effective in reducing the vibration excitation. One of these shapes, the trailing edge bevel, is re-examined in an attempt to gain a clearer understanding of the mechanism by which it achieves satisfactory suppression of vibrations. ESRO

N73-21912# Naval Ordnance Lab., White Oak, Md.
THE STATIC AND MAGNUS AERODYNAMIC CHARACTERISTICS OF THE M823 RESEARCH STORE EQUIPPED WITH FIXED AND FREELY SPINNING STABILIZERS
Frank J. Regan and Mary E. Falusi 1 Dec. 1972 160 p refs
(AD-757658; NOLTR-72-291) Avail: NTIS CSCL 19/2

The report is the first in a two-part series of technical reports on the dynamics and aerodynamics of free-fall stores using freely spinning stabilizers. Presented are the results of recent wind-tunnel measurements of the normal force, pitching moment and Magnus force and moment on the M823 Research Store in transonic flow. Comparisons are made between configurations equipped with fixed and freely spinning stabilizers, with regard to sign and relative magnitude of the Magnus force and moment. A method is presented and applied whereby the Magnus force and moment are corrected for flow angularity. Author (GRA)

N73-21913# Naval Weapons Lab., Dahlgren, Va. Surface Warfare Dept.
BODY ALONE AERODYNAMICS OF GUIDED AND UNGUIDED PROJECTILES AT SUBSONIC, TRANSONIC AND SUPERSONIC MACH NUMBERS
Frank G. Moore Nov. 1972 122 p refs
(AD-754098; NWL-TR-2796) Avail: NTIS CSCL 16/2

Several theoretical and empirical methods are combined into a single computer program to predict lift, drag, and center of pressure on bodies of revolution at subsonic, transonic, and supersonic Mach numbers. The body geometries can be quite general in that pointed, spherically blunt, or truncated noses are allowed as well as discontinuities in nose shape. Particular emphasis is placed on methods which yield accuracies of ninety percent or better for most configurations but yet are computationally fast. Theoretical and experimental results are presented for several projectiles and a computer program listing is included as an appendix. Author (GRA)

N73-21914# Douglas Aircraft Co., Inc., Long Beach, Calif.
CALCULATION OF POTENTIAL FLOW ABOUT ARBITRARY THREE-DIMENSIONAL LIFTING BODIES Final Technical Report
John L. Hess Oct. 1972 166 p refs
(Contract N00019-71-C-0524)
(AD-755480; MDC-J5679-01) Avail: NTIS CSCL 01/3

The report presents a complete discussion of a method for calculating potential flow about arbitrary lifting three-dimensional bodies without the approximations inherent in lifting-surface theories. The basic formulation of three-dimensional lifting flow is pursued at some length and some difficulties are pointed out. All aspects of the flow calculation method are discussed, and alternate procedures for various aspects of the calculation are compared and evaluated. Particular emphasis is placed on the handling of the bound vorticity and the application of the Kutta condition, and it is concluded that the approach used in the method of this report has certain advantages over alternate schemes used by other existing methods. A considerable number of calculated results for various configurations are presented to illustrate the power and scope of the method. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-21915 Georgia Inst. of Tech., Atlanta.
A COLLISION AVOIDANCE WARNING CRITERION FOR MANEUVERING AIRCRAFT Ph.D. Thesis
Roscoe McClendon Hinson, Jr. 1972 99 p
Avail: Univ. Microfilms Order No. 72-26306

An effective aircraft collision avoidance system must incorporate a means to discriminate between aircraft which pose a threat of collision and aircraft which do not. This problem of discrimination becomes especially difficult in areas where the aircraft densities are high and where aircraft maneuvers occur frequently. The purpose of this research was to develop a warning criterion suitable for this environment. The aircraft flight paths were considered to be stochastic processes and the warning criterion was therefore based on the probability of a collision.
Dissert. Abstr.

N73-21916 Dartmouth Coll., Hanover, N.H.
THE DESIGN OF A VERTICAL TAKEOFF AND LANDING

AIRCRAFT FOR THE GENERAL AVIATION MARKET Ph.D. Thesis
John Craig Harding 1972 157 p
Avail: Univ. Microfilms Order No. 72-23515

Examination of the air transportation system of the United States indicates a trend in scheduled airline service toward longer routes between major population centers and abandonment of regional low density routes. It is left to general aviation to provide the remainder of the air transportation network. VTOL capability is presented as a means of enhancing the ability of general aviation aircraft to provide comprehensive regional air transportation. Specifications for a single-engine, four-place VTOL aircraft are generated with particular emphasis on noise and safety considerations. Evaluation of VTOL configurations leads to the selection of a tilt-duct configuration as being the most compatible with the design requirements. A twin ducted propeller aircraft is designed which utilizes inertial energy storage to meet transient power demands and provide emergency vertical landing capability. Dissert. Abstr.

N73-21917# Aviation Advisory Commission, Washington, D.C.
THE LONG RANGE NEEDS OF AVIATION
1 Jan. 1973 256 p refs
Avail: NTIS HC $15.00

An investigation is made of a wide range of problems affecting civil aviation in the United States today. Among these are: the airport environment; air and ground congestion; the need for service to small communities; the role of private aviation; the multijurisdictional process; the ailing aerospace manufacturing industry; the ensnarled regulatory process; and safety. Recommendations aimed at equitable solutions for these problems are provided. J.M.M.

N73-21918# Federal Aviation Administration, Washington, D.C.
A LOOK AT A FORECAST, PART 4
R. B. Bratbak Dec. 1971 28 p
(Rept-72-02326) Avail: NTIS HC $3.50

A baseline scenario is provided in detail which forecasts air passenger trends over the North Atlantic to 1976. These projected trends are founded upon likely economic influences in both Europe and the United States during the next three years. The impact of the SST on tourist and business travel is also appraised. J.M.M.

N73-21919# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ATC CONCEPTS FOR V/STOL VEHICLES, PARTS 1 AND 2 Final Report, Mar. 1971 - Aug. 1972
Sidney B. Rossiter, John Maurer, and Paul J. Obrien Apr. 1973 65 p ref
(FAA Proj. 150-190)
(FAA-NA-72-95; FAA-RD-73-47) Avail: NTIS HC $5.25

Two dynamic simulations were conducted, using saturated STOL aircraft traffic sample inputs, to study the effects of various aspects of STOL aircraft operations within the air traffic control system. One investigated the effects of STOL aircraft operating at a downtown STOLport within the New York terminal area complex; the other investigated the effect of STOL aircraft operating on various configurations of STOL runways at a high-density, multirunway, conventional takeoff and landing (CTOL) airport. It was concluded that STOL operations can be accommodated at a downtown STOLport; however, where airspace is limited, intricate profiles requiring a high degree of aircraft performance may be required. The performance of these profiles should be an onboard responsibility using highly accurate area navigation equipments with the ATC facility serving as a monitor. The current method of controller speed commands can be used as an interim method of metering and spacing pending more sophisticated methods, but requires flexible aircraft speed parameters and close cooperation between pilot and controller. It was further concluded that the least effect on CTOL operations at a CTOL/STOL airport is achieved by a parallel system of STOL runways bordering upon the CTOL complex. Author

N73-21920# Advisory Group for Aerospace Research and Development, Paris (France).
HELICOPTER BLADE FLUTTER Revision of Part 3, Chapter 10 of AGARD Manual on Aeroelasticity
N. D. Ham (MIT, Cambridge) Jan. 1973 37 p refs
(AGARD-R-607) Avail: NTIS HC $4.00

Methods of analysis of helicopter blade flutter for both hinged and hingeless blades are presented. The major types considered are bending-torsion flutter, flap-lag flutter, and stall flutter. Both hover and forward flight are considered. Means of avoiding flutter are described. Author

N73-21921*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED AUGMENTOR-WING RESEARCH
Thomas N. Aiken Oct. 1972 11 p refs
(NASA-TM-X-62250) Avail: NTIS HC $3.00 CSCL 01B

Results of research on advanced augmentors are discussed. Research concerned with performance indicated that: (1) augmentors with lobe-type nozzles give higher thrust augmentation than those with slot-type primary nozzles; (2) the thrust of augmentor wings at forward speed is greater than that of internally blown flaps for the speed range of interest; and (3) the optimum augmentor geometry at forward speed may be different from the optimum static geometry. Analysis of augmentor-wing data shows that the data may be correlated by accounting for the augmentation and entrainment in defining a net thrust coefficient. Author

N73-21922*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OBLIQUE-WING SONIC BOOM
Raymond M. Hicks and Joel P. Mendoza Feb. 1973 17 p refs
(NASA-TM-X-62247) Avail: NTIS HC $3.00 CSCL 20A

An investigation was conducted to determine the magnitude of the groundtrack overpressure generated by an oblique-wing transport cruising at Mach 1.4 at 45,000 ft. A conventional swept-wing configuration was included in the study to provide a basis of comparison for the oblique-wing configuration. The results of the investigation have shown that the oblique-wing configuration produces less sonic boom overpressure at cruise lift coeffiicent than the swept-wing vehicle. Author

N73-21923*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF A SWEPT AUGMENTOR WING
David G. Koenig and Michael D. Falarski (Army Air Mobility R and D Lab., Moffett Field, Calif.) Oct. 1972 24 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62252) Avail: NTIS HC $3.25 CSCL 01B

A brief outline of augmentor wing research is presented and is followed by a discussion of large scale wind tunnel test results for a swept augmentor wing configuration. The results show that the augmentor wing can be applied to high speed swept wing designs with little adverse effect on either the basic performance of the augmentor or the longitudinal characteristics, including maximum lift and stall. Three lateral control devices were shown to be effective and ground effect was measured for several complete aircraft configurations. Author

N73-21924*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACOUSTIC CHARACTERISTICS OF LARGE-SCALE STOL MODEL AT FORWARD SPEED
Michael D. Falarski (Army Air Mobility R and D Lab., Moffett Field, Calif.), Kiyoshi Aoyagi, and David G. Koenig Oct. 1972 13 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62251) Avail: NTIS HC $3.00 CSCL 01C

Wind-tunnel investigations of the acoustic characteristics of the externally blown jet flap (EBF) and augmentor wing STOL concepts are dicussed. The large-scale EBF model was equipped with a triple-slotted blown by four JT15D turbofan engines with circular, coannular exhaust nozzles. The large-scale augmentor wing model was equipped with an unlined augmentor blown by a slot primary nozzle. The effects of airspeed and angle of attack on the acoustics of the EBF were small. At a forward speed of 60 knots, the impingement noise of the landing flap was approximately 2 db lower than in the static tests. Angle of

attack increased the impingement noise approximately 0.1 decibels per degree. Flap deflection had a greater effect on the acoustics of the augmentor wing than did airspeed. For a nozzle pressure ratio of 1.9, the peak perceived noise level of the landing flap was 3 to 5 PNdb higher than that of the takeoff flap. The total sound power was also significantly higher for landing indicating that turning in the augmentor generated acoustic energy. Airspeed produced a small aft shift in acoustic directivity with no significant change in the peak perceived noise levels or sound power levels. Author

N73-21925# Federal Aviation Administration, Washington, D.C. Office of Aviation Economics.
SURVEY OF DULLES AIRPORT INTERNATIONAL PASSENGERS, YEAR ENDING APRIL 1972
Mar. 1973 15 p
Avail: NTIS HC $3.00

A survey of air passengers flying from Dulles Airport was conducted for a period of one year. A survey questionnaire containing 24 questions was used to obtain the opinions of the air passengers. Details concerning age groups of travelers, annual income, occupations, residence, transportation mode to Dulles Airport, main destination, and main purpose of the trip were reported. Author

N73-21926*# Bell Helicopter Co., Fort Worth, Tex.
V/STOL TILT-ROTOR STUDY, TASK 1. VOLUME 1: CONCEPTUAL DESIGN
[1972] 58 p 4 Vol.
(Contract NAS2-6599)
(NASA-CR-114441; Rept-300-099-005-Vol-1) Avail: NTIS HC $5.00 CSCL 01C

A conceptual design study was conducted to define a representative military and/or commercial tilt-propeller aircraft for short takeoff and landing operation. The level of structural technology selected for the operational aircraft was based on aluminum, steel, titanium, and adhesive bonded structures. The data describe the following: (1) aircraft weight, (2) performance and stability, (3) aerodynamic noise, (4) dynamic characteristics, (5) maintainability and reliability, and (6) operating economics. Author

N73-21927*# Bell Helicopter Co., Fort Worth, Tex.
V/STOL TILT-ROTOR STUDY, TASK 2. VOLUME 2: RESEARCH AIRCRAFT DESIGN
[1972] 254 p refs 4 Vol.
(Contract NAS2-6599)
(NASA-CR-114442; Rept-300-099-006-Vol-2) Avail: NTIS HC $14.75 CSCL 01C

For abstract, see N73-21938.

N73-21928*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EFFECT OF CROSSFLOW VELOCITY ON VTOL LIFT FAN BLADE PASSING FREQUENCY NOISE GENERATION
D. L. Stimpert Feb. 1973 56 p refs
(Contract NAS2-5462)
(NASA-CR-114566) Avail: NTIS HC $5.00 CSCL 01C

Analysis of noise measurements taken during tests of a remote lift fan wing installation, a V/STOL model transport with both lift and lift/cruise fans, and XV5B research aircraft flight tests has indicated a definite increase in pure tone sound pressure level due to crossflow over the face of the life fans. The fan-in-wing and V/STOL model transport tests were conducted in the NASA Ames 40 ft. by 80 ft. wing tunnel and the XV5B flight tests at Moffett Field. Increases up to 10 db were observed for the lift fan installation tested at crossflow to fan tip velocity ratios up to 0.25. Cruise fan noise levels were found to be unaffected by the external flow. The noise level increase was shown to be related to an increase in fan distortion levels. Author

N73-21929*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EFFECT OF CROSSFLOW VELOCITY ON THE GENERATION OF LIFT FAN JET NOISE IN VTOL AIRCRAFT
D. L. Stimpert and R. G. Fogg Feb. 1973 43 p refs
(Contract NAS2-5462)
(NASA-CR-114571) Avail: NTIS HC $4.25 CSCL 01C

Analytical studies based on a turbulent mixing noise prediction technique indicate that jet noise power levels are increased when a jet is situated in a crossflow. V/STOL model transport acoustic test data obtained in the NASA Ames 40 ft. x 80 ft. wind tunnel confirmed this jet noise power level increase due to crossflow. Increases up to 6 db at a Strouhal number of 2.5 and crossflow velocity to jet velocity ratio of 0.58 were observed. The power level increases observed in the experimental data confirm the predicted power level increases. Author

N73-21930*# North American Aviation, Inc., Los Angeles, Calif.
CONCEPTUAL DESIGN STUDY OF A V/STOL LIFT FAN COMMERCIAL SHORT HAUL TRANSPORT
Ronald G. Knight, William V. Powell, Jr., and Jerome A. Prizlow Washington NASA Apr. 1973 136 p refs
(Contract NAS2-6564)
(NASA-CR-2185) Avail: NTIS HC $3.00 CSCL 01C

Conceptual designs of V/STOL lift fan commercial short haul transport aircraft for the 1980-85 time period were studied to determine their technical and economic feasibility. The engine concepts included both integral and remote fans. The scope of the study included definition of the hover control concept for each propulsion system, aircraft design, mass properties, cruise performance, noise and ride qualities evaluation. Economic evaluation was also studied on the basis of direct-operating costs and route structure. Author

N73-21931# Advisory Group for Aerospace Research and Development, Paris (France).
AERODYNAMICS OF ROTARY WINGS
Norman D. Ham (MIT) Mar. 1973 9 p refs Presented at Fluid Dyn. Panel Specialists Meeting, Marseille, 13-15 Sep. 1972
(AGARD-AR-61; AGARD-CP-111) Avail: NTIS HC $3.00

The proceedings of a conference to discuss the aerodynamics of rotary wings are presented. The subjects discussed are: (1) rotor wakes, (2) rotors at hover and at high advance ratio, (3) rotor unsteady airloads, (4) rotor airfoils, (5) rotor configurations, and (6) noise generated by rotary wings. P.N.F.

N73-21932*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY INVESTIGATION OF INLET INGESTION OF A WING TIP VORTEX
Glenn A. Mitchell Apr. 1973 42 p refs
(NASA-TM-X-68225) Avail: NTIS HC $4.25 CSCL 01B

An inlet-coldpipe assembly was placed in a Mach 0.4 stream to ingest the tip vortex of a forward mounted wing. The strongest vortex was produced by a wing angle of attack of 11 degrees. The vortex displayed a tangential velocity of 57 percent of local stream velocity prior to entering the inlet, and a tangential velocity of 25 percent of local velocity at the simulated compressor-face. The total-pressure profiles measured by standard compressor-face rakes were changed by the presence of the vortex only at the highest tested inlet mass-flow ratios. Author

N73-21933# Federal Aviation Administration, Washington, D.C. Engineering and Manufacturing Div.
DETERMINATION OF TURBINE ENGINE PERFORMANCE MARGINS IN TRANSPORT AIRCRAFT
Robert F. Nugent Jul. 1972 14 p
(FS-140-72-2) Avail: NTIS HC $3.00

An investigation of turbine engine performance difficulties in commercial transport aircraft is described. Recommendations are made for an FAA/ industry collaborative program for developing certification criteria to control the factors responsible for stall, slow acceleration, and flameout on aircraft engines in service. Author

N73-21934# Federal Aviation Administration, Washington, D.C. Flight Standards Service.
SERVICE EXPERIENCE WITH LIQUID NITROGEN FUEL TANK INERTING SYSTEM IN FAA DC-9 AIRCRAFT, N119 Final Report
Joseph Haddad, William C. McAdoo, and Oscar C. Ball Jun. 1972 50 p
(FS-140-72-1) Avail: NTIS HC $4.50

Determination is made of the nitrogen consumption, system

reliability, maintenance burden, and costs which are associated with the installation and operation of a liquid nitrogen fuel tank inerting system installed in the FAA DC-9 airplane, N119. It is assumed that the data can be extrapolated to a typical airline type of operation of a DC-9 and other jet transport aircraft. Author

N73-21935# Federal Aviation Administration, Washington, D.C.
A LOOK AT FLIGHTS, PART 5
R. B. Bratbak Jun. 1972 28 p
Avail: NTIS HC $3.50

An analysis of trans-Atlantic aircraft movements for the 1970 to 1971 time period was conducted. A base line for all air routes was derived from Oceanic Control Center statistics, United Kingdom, United States, and Canadian Government aviation statistics, IATA statistics, and Air Transport media publications. The data are presented in the form of tables and charts. Author

N73-21936# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: NORTH AMERICAN ROCKWELL, INCORPORATED, TURBO COMMANDER 690, NINR, WELLSBURG, WEST VIRGINIA, 14 AUGUST 1972
14 Aug. 1972 12 p
(NTSB-AAR-73-5) Avail: NTIS HC $3.00

An aircraft accident involving the crash of a Turbo Commander aircraft near Wellsburg, West Virginia on 14 August, 1972 is reported. The aircraft departed the Greater Pittsburgh International Airport, Pittsburgh, Pennsylvania on a training flight and reported reaching an altitude of 12,500 feet. Approximately nine minutes after takeoff the ground control facilities lost radar and radio contact with the aircraft. The probable cause of the accident was loss of aircraft control in a stall maneuver from which recovery was not accomplished. Author

N73-21937# Federal Aviation Administration, Washington, D.C.
A LOOK AT SOME ARTIFACTS, PART 2
R. B. Bratbak Nov. 1971 23 p
Avail: NTIS HC $3.25

An analysis of air passenger traffic on North Atlantic air routes was conducted. The discussions include: (1) the development of scheduled service, (2) charter flights, and (3) promotional fare plans. Some alternative explanations are offered for these events and conclusions are drawn on the implications of the data. Author

N73-21938# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ABBREVIATED INVESTIGATION OF THE DOUGLAS DC-10 AIRPLANE VORTEX WAKE CHARACTERISTICS IN TERMINAL AREA-TYPE OPERATIONS
Leo J. Garodz, William J. Hanley, and Nelson J. Miller Aug. 1972 30 p refs
(Proj. 214-741-04X)
(Rept-73-00470; FS-2-73) Avail: NTIS HC $3.00

A flight test program was conducted to obtain data on and analyze the time history characteristics of the vortex system of a DC-10 aircraft. The purpose of the tests was to develop air traffic control separation criteria associated with simultaneous operations of various mixes of aircraft with the DC-10 upon its introduction into airline operations. The major parameters considered were aircraft vortex flow tangential velocities, the field of influence, and the persistency of the turbulent vortex. Author

N73-21939# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THREE-DIMENSIONAL POTENTIAL LIFTING FLOW [ECOULEMENT A POTENTIEL TRIDIMENSIONNEL PORTANT]
G. Heckmann and W. Vitte [1972] 60 p refs In FRENCH
(DGT-7510) Avail: NTIS HC $5.00

The application is discussed of computer graphics to the determination of aerodynamic loads on three-dimensional lifting bodies in a potential flow from a system of nonlinear equations. Nonlinearities are caused by unknown position and forms of wakes, and the Kutta-Joukowski condition. The mathematical scheme chosen is based on a geometrical discretization of the body and a distribution relating to singularities, sinks, sources and vortices. The basic forms of the wing and the fuselage are stored in the computer memory and programs supply the necessary geometric elements. These geometric forms are discretized three-dimensionally and produce the representation of the aircraft by a set of quadrilaterals. These different operations are controlled by a visual display console, which allows the design optimization of the aircraft by an iterative procedure. ESRO

N73-21940# Institut Franco-Allemand de Recherches, St. Louis (France).
EFFECT OF SONIC BOOM ON AVALANCHES. PREPARATION FOR FLIGHT OF A SUPERSONIC JET OVER THE LAVEY VALLEY [EFFET DU BANG SUR LES AVALANCHES. PREPARATION DU SURVOL DE LA VALLEE DE LA LAVEY PAR UN AVION A VITESSE SUPERSONIQUE]
M. Schaffar, B. Carrie, and L. P. Amardei 6 Jun. 1972 48 p refs In FRENCH
(Contract DRME-72/337)
(ISL-13/72) Avail: NTIS HC $4.50

An experiment to determine the effect of sonic booms on the stability of the snow mantle in the Lavey Valley is proposed. It includes provisions for the aircraft trajectory, line of focus, boom zone, as well as the determination of boom intensity levels for the whole valley. ESRO

N73-21941# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFORMATION MATERIALS ADAPTIVE SYSTEMS
26 Dec. 1972 171 p refs Transl. into ENGLISH from Tr. Inform. Materialy (Moscow), 1970 p 1-19, 29-36
(AD-756598; FTD-HC-23-1018-72) Avail: NTIS CSCL 01/3

The report includes the realization of adaptive control algorithms, elements of adaptive control systems, self-adjusting control systems for an aeroelastic aircraft, adaptive control of flight vehicle roll, flight vehicle control during atmospheric reentry, parametrically invariant control systems, statistical estimation in monitoring and control problems, choosing the transfer function of a standard model of a self-adjusting control system, the equations of motion of bodies of variable mass, the synthesis of nonsearching self-adjusting control systems, the development of a criterion for comparing adaptive control systems, the structure of a digital self-adjusting system with a model, the synthesis of a self-adjusting autopilot, and the special features of fixed-adjustment control systems. Author (GRA)

N73-21942# Army Foreign Science and Technology Center, Charlottesville, Va.
AUTOROTATION OF COAXIAL HELICOPTERS
I. Grigorev 24 Aug. 1972 9 p refs Transl. into ENGLISH from Graz. Aviat. (USSR), no. 6, 1970
(AD-756592; FSTC-HT-23-480-72) Avail: NTIS CSCL 01/3

The report describes the flight characteristics of a helicopter with functionable engines but with the transmission disengaged and in a steady autorotation configuration. GRA

N73-21943# Naval Weapons Evaluation Facility, Albuquerque, N.Mex.
SH-3G HELICOPTER EXTERNAL CARGO HOOK SYSTEM SAFETY ANALYSIS
R. L. Clark and G. L. Finley 28 Feb. 1973 42 p refs
(AD-757001; NWEF-1099) Avail: NTIS CSCL 15/6

The report describes the SP-7086-1 external cargo hook used with the SH-3G helicopter, reviews the mechanical and electrical design of the hook system, analyzes possible failure modes and known hook failures, and reviews manufacturer's flight, and vertical replenishment tests that have been conducted on the hook. Author (GRA)

N73-21944# Army Electronics Command, Fort Monmouth, N.J.
STABILITY AND CONTROL OF THE HELICOPTER WHEN USED AS A WEAPONS PLATFORM FOR AERODYNAMICALLY STABILIZED ROCKETS
Robert W. Campagna Feb. 1973 116 p refs
(DA Proj. 1F1-62202-A-A97)
(AD-756436; ECOM-4078) Avail: NTIS CSCL 19/5

The report is concerned with stability and control of the helicopter when used as a weapons platform for aerodynamically stabilized rockets. Analysis and simulation are used to ascertain

problem areas that exist when engagement techniques similar to those used for fixed wing aircraft are used for helicopters. It is shown that significant improvements in helicopter controllability and rocket accuracy can be achieved by utilizing an impact prediction calculation which accounts for the relative wind on the rocket launching tubes. Author (GRA)

N73-21945# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), OH-58A ENGINE Interim Technical Report, 1 Jan. 1964 - 1 Jul. 1971
Oct. 1972 23 p
(AD-756406; USAAVSCOM-TR-72-23) Avail: NTIS CSCL 01/3

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N73-21946# Army Electronics Command, Fort Monmouth, N.J.
SIMULATION OF HELICOPTER CONTAINERSHIP LOADING
William Keane and David Usechak Jan. 1973 39 p refs
(DA Proj. 1F1-62202-A-2)
(AD-756865; ECOM-4062) Avail: NTIS CSCL 01/3

The report describes a real-time computer simulation of a Heavy Lift Helicopter containership loading/unloading system. The purpose is to determine helicopter-man/machine system interaction to containership motion. By using several different display/control systems, the positioning capabilities of the helicopter when placing loads in a containership held was determined. The effort was in support of the Heavy Lift Helicopter program sponsored by the US Army Combat Developments Command Aviation Agency, Fort Rucker, Alabama.
Author (GRA)

N73-21947# Coast Guard, San Francisco, Calif.
AIR CUSHION VEHICLE EVALUATION, SAN FRANCISCO, CALIFORNIA, ST. IGNACE, MICHIGAN, MILFORD HAVEN, VIRGINIA, TRANSPO 72 Evaluation Report, 1 Sep. 1971 - 30 Jun. 1972
Thomas C. Lutton 30 Jun. 1972 149 p
(AD-755409; ACV-EU-3960-2) Avail: NTIS CSCL 01/3

The United States Coast Guard has completed an extensive eighteen month evaluation of air cushion vehicles to determine their potential usefulness in meeting its expanding missions and responsibilities. During the ten month period of this second phase, it has operated the air cushion vehicles over 800 hours in San Francisco, the Northern Great Lakes, and the Chesapeake Bay regions. The operating areas have included the ice of Lake Huron, the narrow passages of the East Coast Intracoastal Waterway, the wide expanses of Chesapeake Bay and the confined spaces of Oakland International Airport. This final evaluation report details the deployments, operations, and special projects conducted by the Evaluation Unit as well as new hovercraft developments.
Author

N73-21948# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF DESIGN IN AIRCRAFT CONSTRUCTION (SELECTED CHAPTERS)
A. L. Gimmelfarb 21 Nov. 1972 233 p refs Transl. into ENGLISH from the book "Osnovy Konstruirovaniya v Samoletostroenii" 1971 p 75-203, 283-308
(AD-755754; FTD-HC-23-1256-72) Avail: NTIS CSCL 01/3

Aircraft construction and design is discussed and riveted connections, calculations and designs, and the advantages are compared to ordinary riveting. Welded joints, bonded joints, and the structural properties of each, are discussed. GRA

N73-21949# Kaman Aerospace Corp., Bloomfield, Conn.
THE CORRELATION AND EVALUATION OF AH-1G, CH-54A, AND OH-6A FLIGHT SPECTRA DATA FROM SOUTHEAST ASIA OPERATIONS Final Report
John D. Porterfield, William A. Smyth, and Paul F. Maloney Oct. 1972 202 p refs
(Contract DAAJ02-71-C-0052)
(AD-755554; R-996; USAAMRDL-TR-72-56) Avail: NTIS CSCL 01/3

The report evaluates the flight spectra data for three vastly different types of helicopters flown under combat conditions in Southeast Asia: the AH-1G, a high-speed gunship; the CH-54A, a heavy-lift helicopter; and the OH-6A, a light, highly maneuverable observation helicopter. The flight spectra data for these three ships were compared to one another, to flight spectra data obtained from other helicopters, and to the spectrum shown in Appendix A of Civil Aeronautics Manual 6. The relationship to empirical fatigue substantiation spectra used to establish component service lives for these three helicopters is also shown. Evaluations and correlations of these spectra are presented; where variations occur, their probable cause and possible effects on fatigue life are discussed. Author (GRA)

N73-21950*# Stanford Univ., Calif. Dept. of Applied Mechanics.
BOUNDS IN NONCONSERVATIVE PROBLEMS OF ELASTIC STABILITY
Shyam N. Prasad (Miss. Univ.) and George Herrmann May 1972 25 p refs
(Grants NGL-05-020-397; AF-AFOSR-1905-70; NSF GK-3092; AF Proj. 9782)
(NASA-CR-131828; AD-746696; SUDAM-72-5; AFOSR-72-0423TR) Avail: NTIS HC $3.25 CSCL 01/3

Synge's method based on the isoperimetric inequality is generalized to study panel flutter and Beck's problem with viscous damping forces. Conditions for stability are derived and also estimates of amplification rates and frequencies of oscillations. Further insight is gained into the destabilizing effect of viscous damping in nonconservative elastic systems. Author (GRA)

N73-21951# Lockheed-Georgia Co., Marietta.
RESPONSE OF AIRCRAFT TO THREE DIMENSIONAL RANDOM TURBULENCE Technical Report, Jul. 1971 - Mar. 1972
Frederick D. Eichenbaum Oct. 1972 105 p refs
(Contract F33615-71-C-1878; AF Proj. 1367)
(AD-756886; AFFDL-TR-72-28) Avail: NTIS CSCL 01/3

Conceptually possible procedures for designing aircraft for the combined effects of vertical, lateral, and longitudinal turbulence by the application of power spectral techniques are developed and outlined. The present state-of-the-art of this technical area is established and evaluated by reviewing and extending current methods used or proposed for predicting the response of aircraft due to combined effects of the three components of atmospheric turbulence. Requirements for solving the problem are identified and recommendations are made with respect to major problem areas such as: description of the turbulence environment, determination of the frequency response function of the structure, and methods of combining the effects of vertical, lateral and longitudinal turbulence components to theoretically predict aircraft response. Author (GRA)

N73-21952# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPROXIMATE METHOD OF CALCULATING THE AERODYNAMIC LOAD DISTRIBUTION ON A LOW-FLYING WING WITH A FUSELAGE
L. G. Tsvetkov 26 Jan. 1973 20 p refs Transl. into ENGLISH from Tr. Korablestroitelnyi Inst. (Leningrad), no. 69, 1970 p 111-121
(AF Proj. 1369)
(AD-756075; FTD-MT-24-1646-72) Avail: NTIS CSCL 01/3

A technique is proposed for the numerical calculation of the aerodynamic load distribution under uniform motion of a wing with an angle of sweepback and an angle of heel, and with a fuselage in the form of an infinite circular cylinder and a zero angle of attack over a solid screen. The wing is modeled by a system of discrete oblique horseshoe shaped vortices. A scheme with 18 vortices was selected. The calculations showed

how the fuselage has a considerable effect on the distribution of aerodynamic load along the wing, the effect being especially great in the motion of the system close to a solid screen.
Author (GRA)

N73-21953# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRACTICAL AERODYNAMICS ON THE AN-12 AIRCRAFT
I. M. Varukha, V. D. Bychkov, and E. L. Smolenskii 17 Nov. 1972 286 p refs Transl. into ENGLISH from the monograph "Prakticheskaya Aerodinamika Samoleta An-12" Moscow, 1971 p 1-180
(AD-756948; FTD-MT-24-1346-72) Avail: NTIS CSCL 01/3
The design and aerodynamic features of the An-12 turboprop aircraft, questions of its handling technique and flight safety are discussed in this book. There is shown the effect of the turboprop power plant on stability, aircraft handling and primary aerodynamic characteristics. The substantiations of a number of design solutions are given. The book is intended for the flying and technical personnel of civil flying and technical personnel of civil aviation. It can be used by flying school cadets and by students of training detachment. Author (GRA)

N73-21954# Flight Dynamics Research Corp., Burbank, Calif.
A COANDA INLET/JET FLAP DIFFUSER EJECTOR Final Technical Report, Jun. 1970 - Aug. 1972
Morton Alperin Aug. 1972 75 p refs
(Contract F33615-70-C-1656; AF Proj. 1366)
(AD-756895; AFFDL-TR-72-106; TR-72-02-01-106) Avail: NTIS CSCL 01/3
The combination of a Coanda inlet and jet flap diffusion, for the achievement of high performance, low volume, thrust augmentation, has been investigated in a two-dimensional experiment. The use of jet flap diffusion provides a mechanism for the achievement of large control forces, through the use of variable jet flap angles, or through the application of incremental power to the jet flap. Vectoring of the total thrust force is achievable through the use of the fluidic effect, which can be utilized to detach the flow from one side of the jet flap, by decreasing the plenum pressure of that side relative to the plenum pressure of the other side. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-21955 Ernst-Mach-Inst., Freiburg (West Germany).
STUDY OF PLATE ROTATION UNDER AIR SHOCK LOADING [UNTERSUCHUNG DER DREHBEWEGUNG EINER PLATTE BEI LUFTSTOSSBELASTUNG]
Gerhard Guerke Apr. 1972 31 p refs In GERMAN; ENGLISH summary
(Rept-3/72) Avail: Issuing Activity
To evaluate some ideas concerning the closure dynamics of slap-valves in ventilation systems, the rotation of a lightweight cover exposed to air shock wave loading in a shocktube was investigated. Two simple methods for predicting the rotation and for measuring the turning moment, using pressure gauge measurements in the flow field experienced by the rotating flap, are presented. The rate of rotation of the plate was observed using a Cranz-Schardin camera, and was in good agreement with predictions. Author (ESRO)

N73-21956*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRANSCRIPT OF PROCEEDINGS: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GODDARD SPACE FLIGHT CENTER, 1972 GSFC BATTERY WORKSHOP, FIRST DAY
1972 275 p
(NASA-TM-X-69240) Avail: NTIS HC $15.75 CSCL 10C
The proceedings of the 1972 NASA/Goddard Battery Workshop are reported. Topics discussed include: separators, materials and processing, test and storage experience, and improved energy density systems. F.O.S.

N73-21957*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRANSCRIPT OF PROCEEDINGS: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GODDARD SPACE FLIGHT CENTER, 1972 GSFC BATTERY WORKSHOP, SECOND DAY
15 Nov. 1972 134 p
(NASA-TM-X-69239) Avail: NTIS HC $8.75 CSCL 10C
For abstract, see N73-21956.

N73-21958*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ACCELERATED TESTING OF SPACE BATTERIES
J. McCallum (Battelle Memorial Labs., Columbus, Ohio), R. E. Thomas (Battelle Memorial Labs., Columbus, Ohio)03(Battelle Memorial Labs., Columbus, Ohio), and J. H. Waite Washington 1973 220 p refs
(NASA-SP-323) Avail: NTIS HC $3.00 CSCL 10C
An accelerated life test program for space batteries is presented that fully satisfies empirical, statistical, and physical criteria for validity. The program includes thermal and other nonmechanical stress analyses as well as mechanical stress, strain, and rate of strain measurements. Author

N73-21959# Royal Aircraft Establishment, Farnborough (England).
STATUS REPORT ON RAE ADVANCED SOLAR ARRAY DEVELOPMENT
F. C. Treble Jul. 1972 31 p refs Presented at the 9th IEEE Photovoltaic Specialists' Conf., Silver Spring, Md., 2-4 May 1972
(RAE-TR-72109; BR-29829) Avail: NTIS HC $3.75
Recent progress in advanced lightweight solar array technology is reviewed. Solar cell performance has been improved. Panel assemblies embodying a cementless mounting technique have successfully withstood prolonged deep thermal cycling and other environmental tests. Some are currently being flown experimentally on the Prospero technological satellite. A stowed array has survived severe vibration with negligible damage. A solution has been found to the problem of protecting the backs of the cells from low energy protons. Useful experience has been gained in all aspects of the manufacture, handling and testing of flexible folding arrays. Design qualification tests have begun on a 280W prototype. The advantages and disadvantages of this fold-up design in relation to the alternative roll-up type are discussed.
Author (ESRO)

N73-21960# Army Foreign Science and Technology Center, Charlottesville, Va.
HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND GADMIUM SELENIDE
V. N. Komashchenko, A. I. Marchenko, and G. A. Fedorus 7 Sep. 1972 11 p refs Transl. into ENGLISH from Poluprov. Tekh. i Mikroelektron. (USSR), no. 4 p 112-121
(AD-756594; FSTC-HT-23-113-72) Avail: NTIS CSCL 20/12
The authors present data on the development and investigation of photoelectric convertors based on pressed sintered tablets of CdS and CdSe, plus somewhat more detailed data on photoelectric convertors based on CdSe films. GRA

N73-21961# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF SOME CYCLES OF COMBINED MACHINE MACHINELESS CONVERTERS OF THERMAL TO ELECTRICAL ENERGY
L. M. Drabkin Jan. 1973 6 p refs Transl. into ENGLISH from Referativnyi Zhur. Elektrotekhn i Energ. (USSR), no. 4, 1970 p 104-107
(AD-756805; FSTC-HT-23-2023-72) Avail: NTIS CSCL 10/2
A thermodynamic analysis is given of a combined machine installation operating on the Brighton cycle, and a thermoelectric generator as a low temperature superstructure. Calculations show that using a generator with an efficiency of 4 percent increases the efficiency of the Brighton cycle by 0.8 percent. An experimental

study of the motor potential showed that a soldered commutation based on low temperature solder (approximately 280 C) is unreliable. A new and more reliable commutation is worked out by sputtering Ni-Cu-Al alloys for batteries directly in the stream of exhaust gases from an internal combustion engine. The use of exhaust gases makes thermoelectric generators competitive with currently used electrodynamic generators. Author (GRA)

N73-21962# Army Foreign Science and Technology Center, Charlottesville, Va.

INVESTIGATION OF PHOTOELECTRIC CHARACTERISTICS OF GALLIUM ARSENIDE SOLAR CELLS OVER A WIDE RANGE OF CHANGE IN LIGHT FLUX

M. B. Kagan and T. L. Lyubashevskaya 2 Jan. 1973 14 p refs Transl. into ENGLISH from Geliotekh. (USSR), no. 2, 1971 p 12-21

(AD-756228; FSTC-HT-23-2027-72) Avail: NTIS CSCL 10/2

The characteristics of gallium arsenide as solar cells in the 4 watt/sq m-72000 watt/sq m illumination range are analyzed in this Russian report. The connection of the observed relationships with the electro-physical parameters of p-n junctions are determined, and compared with silicon. GRA

N73-21963# Army Electronics Command, Fort Monmouth, N.J.

CHARACTERISTICS OF CONVENTIONAL DESIGN NICKEL-ZINC BATTERIES FOR HYBRID VEHICLE OPERATION

Martin J. Sulkes Dec. 1972 28 p refs

(AD-756431; ECOM-4058) Avail: NTIS CSCL 10/3

Preliminary evaluations have been conducted on conventional 35 Ah nickel-zinc batteries for hybrid electric vehicle service. On a pulse type of service, adequate recharge is obtained by constant potential charging at 1.85 V/cell. Discharge voltages of approximately 1.7 V/cell are obtained at a 55 A load. Cycling data are reported for a total 3,300 Ah output (5% of total requirement) and includes discharge voltages at 55 and 350 A, and charge input. Heat generation during cycling for conventional cells is approximately 13 Btu/h/cell. Improved cells should generate approximagely 1/2 as much heat. Author (GRA)

N73-21964# Naval Ordnance Lab., White Oak, Md.

PRELIMINARY STUDY OF A LITHIUM ALUMINUM ELECTRODE FOR THERMAL BATTERIES

Stanley D. James 22 Jan. 1973 23 p refs

(AD-757007; NOLTR-72-224) Avail: NTIS CSCL 10/2

Laboratory tests have shown that a 25 weight percent alloy of lithium in aluminum should significantly outperform the calcium anode presently used in thermal batteries. The usable energy and power densities of this solid Li alloy are at least double those of a Ca anode. Aluminum wires were cathodically charged with Li in the LiCl-KCl eutectic melt at 430C. Discharge behavior was then studied in the same melt. Data showed the charging process to be much less polarized than the discharge. Discharge capacity is inversely related to discharge rate and shows discharge to be terminated by diffusion polarization. Both charge and discharge are possible at high rates due to extensive cracking of the metal, allowing melt to contact a very large electrode area. Author (GRA)

N73-21965# Boston Coll., Chestnut Hill, Mass. Dept. of Chemistry.

LOW-MELTING FUSED-SALT ELECTROLYTES Final Report

A. C. Makrides 1972 31 p refs

(Contract DAAG39-72-C-0067; DA Proj. 1T0-61102-A-34A; HDL Proj. 901394)

(AD-755528; HDL-TR-0067-1) Avail: NTIS CSCL 10/2

Current thermal cells operate at relatively high temperatures (400-600C) and have relatively short operating lives. Low-melting fused salts are attractive, in principle, for reserve type cells since they simplify considerably materials problems encountered at the higher temperature. An exploratory survey made to assess in a preliminary fashion development of a low-melting fused salt electrolyte is described. Two main classes of low-melting salts were examined briefly: organic fused salts (with and without solvent) and low melting inorganic salts. In all cases, lead was employed as the anode. Cathodes were either lead dioxide or silver chloride. GRA

N73-21966# Energy Research Corp., Bethel, Conn.

MATRICES FOR H3PO4 FUEL CELLS Semiannual Technical Report, 15 Mar. - 15 Sep. 1972

Ralph N. Camp, Allan Nowotka, and Bernard S. Baker Dec. 1972 53 p refs

(Contract DAAK02-72-C-0247; DA Proj. 1T6-62119-A-012)

(AD-755206; ERC-0959S) Avail: NTIS CSCL 10/2

The research was part of a program on the use of phosphoric acid fuel cells fueled by dirty hydrogen produced by thermocracking or steam reforming of a hydrocarbon. Matrices and anodes for phosphoric acid fuel cells have been developed and tested. Matrices showing no appreciable degradation in performance (bubble pressure) over 1000 hours have been made. These matrices contain Kynol and a phenolic thermosetting binder. Anodes capable of operation in fuel mixtures containing up to 2% carbon monoxide and hydrogen have been tested in fuel cells. These anodes, containing less than 2 milligrams of noble metal per square centimeter, have been operating at satisfactory performance levels for more than 2000 hours.

Author (GRA)

N73-21967# Energy Research Corp., Bethel, Conn.

HIGH ENERGY SEALED NICKEL-ZINC BATTERIES Semiannual Report, 1 Mar. - 1 Sep. 1972

Allen Charkey Jan. 1973 36 p refs

(Contract DAAB07-72-C-0114)

(AD-755550; ECOM-0114-S) Avail: NTIS CSCL 10/3

The construction and performance details for 4 cell sealed nickel-zinc batteries are presented. The batteries evaluated contained non-sintered positive nickel-hydroxide electrodes, Teflonated zinc oxide negative, Ag/Hg oxygen recombination electrodes and inorganic separators containing a Teflon binder. Initially the capacities of the batteries were about 8.2Ah and yielded an energy density of almost 30Wh/lb. The swelling problems of the nickel hydroxide electrode were investigated.

GRA

N73-21968# Army Electronics Command, Fort Monmouth, N.J.

GRAPHITE INTERCALATION COMPOUNDS AS DEPOLARIZERS IN ORGANIC ELECTROLYTE BATTERIES

Herbert F. Hunger and George J. Heymach Nov. 1972 41 p refs

(DA Proj. 1T0-61102-A-34A)

(AD-755159; ECOM-4047) Avail: NTIS CSCL 10/3

Graphite oxide and graphite fluorides were investigated as depolarizers in lithium/organic electrolyte/depolarizer cells at room temperature. The preparation and characterization of the compounds, as well as that of electrolytes and electrodes, are discussed. The kinetics of the intercalation compounds and their discharge characteristics are presented. A comparison is made of the energy content of the various compounds as a function of discharge rate, electrolyte anion, and solvent. Obtainable energy densities of practical cells are estimated. Author (GRA)

N73-21969# TRW Systems Group, Redondo Beach, Calif.

DEVELOP HIGH CHARGE AND DISCHARGE RATE LEAD/ACID BATTERY TECHNOLOGY Final Report, 28 Apr. 1971 - 18 Mar. 1972

H. P. Silverman Apr. 1972 170 p refs

(Contract EPA-68-04-0028)

(PB-213257; TRW-18353-6006-RO-00; APTD-1345) Avail: NTIS CSCL 10C

The objective of the program was to develop a high charge rate, high discharge rate lead-acid battery compatible with the requirements of a hybrid heat-engine/electric vehicle. Because the power requirements and charge-discharge profiles for a hybrid-vehicle battery are sufficiently different than those for a conventional lead-acid battery, a development program was undertaken to optimize the lead-acid battery for hybrid-vehicle use. As a result of this program, ten test cells producing specific powers of 150 W/lb for a 75-sec discharge and 204 W/lb for a 20-sec discharge were developed and tested. The achievements under the program included: fabrication of thin, conductive vitreous carbon-epoxy substrates, chemically inert to lead-acid cell environment; a method for applying (pasting) the active material onto the substrate; and negative bipolar plates that exceeded the performance target of 2A/sq in (0.3 A/sq cm) at 1.5V for

60 sec and out performed standard pasted plates.
Author (GRA)

N73-21970# Army Foreign Science and Technology Center, Charlottesville, Va.
INFLUENCE OF CIRCUIT ELEMENT PARAMETERS ON CAPACITANCE CHARACTERISTICS OF SILVER-ZINC STORAGE BATTERIES DURING CHARGING WITH ASYMMETRIC ALTERNATING CURRENT
V. V. Bayunov and M. A. Dasoyan 15 Jan. 1972 7 p refs Transl. into ENGLISH from Elektrotekhnnika (Moscow), no. 8, 1970 p 50-51
(AD-756955; FSTC-HC-23-1160-72) Avail: NTIS CSCL 10/2
The effect of active, inductive and capacitive resistance of the elements of an asymmetric alternating current (aac) battery charger on the discharged characteristics of silver-zinc storage batteries is examined in the Russian report. It is shown that the capacitive resistance of the storage batteries has the greatest effect. Author (GRA)

N73-21971# Army Foreign Science and Technology Center, Charlottesville, Va.
EFFECTIVENESS OF SOLAR CELLS BASED ON CdS-CuZ-xS HETEROJUNCTIONS
S. Yu. Pavelets 22 Dec. 1972 10 p refs Transl. into ENGLISH from Geliotekhnika, Akad. Nauk Uz. SSR (Tashkent), no. 3, 1971 p 3-8
(AD-756602; FSTC-HT-23-2032-72) Avail: NTIS CSCL 10/2
Analysis of loss and chances of efficiency increase in CdS-Cu(2-x)S photoconverters with impurity light absorption shows that effective photocells can be produced only with use of the drift field and characteristics of the flow of the chemical reaction which forms Cu(2-x)S on the CdS surface. The Russian report discusses the fact that further progress is possible in the production of solar batteries based on CdS-Cu(2-x)S heterojunctions as a result of selection of the optimum mode of chemical treatment, in the presence of the optimum polycrystalline structure of CdS layers. GRA

N73-21972# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMOELECTRIC EFFECTS ON THE BOUNDARY OF SOLID AND LIQUID PHASES OF TERNARY SEMICONDUCTORS AND ALLOYS OF THE A-12B-IVC-V13 TYPE
K. Dovletov, O. P. Astakhov, and L. I. Berger 2 Jan. 1973 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk Turkm. SSR, Ser. Fiz.-Tekhn. Khim. i Geol. Nauk (Ashkhabad), no. 2, 1971 p 94-96
(AD-756899; FSTC-HT-23-2029-72) Avail: NTIS CSCL 10/2
An analysis of the thermoelectric effects on the solid-liquid phase boundary was carried out. The contribution of Peltier heat to the thermoelement heat balance was evaluated. Semiconductors, in which the thermoemf and Peltier coefficient either increase or change slightly, during transition from the solid to the liquid state, are more promising for use in a thermoelement. GRA

N73-21973# Army Foreign Science and Technology Center, Charlottesville, Va.
SPACE ELECTRIC POWER PLANTS, PART 2
M. Korolev 7 Feb. 1973 7 p Transl. into ENGLISH from Pravda (Moscow), no. 161, 10 Jun. 1971 p 3
(AD-756039; FSTC-HT-23-921-72) Avail: NTIS CSCL 10/2
Solar batteries and power cells are discussed. 7,500 photocells comprising a panel 1 meter square generate more than 100 watts of electrical energy. Space service life of certain semiconductors is given as two to three years. Glass coatings protect panels from heavy protons. Reference is made to the Boeing Co. project of unfolding glass fabric panels for space use. Korolev also states that Soviet scientists confirm the feasibility of such a project but claim that it will be surpassed. Thin film highly efficient photocell panels have been developed in the USSR. Reference is made to an unspecified plant/factory which manufactures not only space power units (using solar energy) but ground solar power plants as well. A 600 watt pilot installation has been in operation in the Karakum desert. Author (GRA)

N73-21974# Army Foreign Science and Technology Center, Charlottesville, Va.
FLUCTUATION OF THE VOLTAGE OF BATTERIES DURING CHARGING WITH AN ASYMMETRICAL ALTERNATING CURRENT
V. V. Bayunov 7 Feb. 1973 8 p refs Transl. into ENGLISH from Sb. Rabot Khim. Istochnikam Toka (Leningrad), no. 4, 1969 p 125-127
(AD-756557; FSTC-HT-23-1758-72) Avail: NTIS CSCL 10/3
The authors discuss the basic parameters of batteries being charged with an asymmetrical alternating current. Particular emphasis is placed on chemical reactions within silver-zinc and lead-acid batteries. Author (GRA)

N73-21975# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), CH-47A AUXILIARY POWER UNIT Interim Report, 1 Jan. 1964 - 1 Jul. 1971
Feb. 1972 23 p refs
(AD-756407; USAAVSCOM-TR-72-21) Avail: NTIS CSCL 10/2
Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain conditions change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-21976 Drexel Univ., Philadelphia, Pa.
CONTROL ANALYSIS AND DESIGN OF DEMAND REGULATED LIQUIDS BREATHING SYSTEMS Ph.D. Thesis
Thomas Hillard Shaffer, III 1972 114 p
Avail: Univ. Microfilms Order No. 72-26959
A demand regulated liquid breathing system was developed which will compensate for increases in respiratory work and provide a means for prolonged periods of liquid ventilation. The basis for demand regulation is to employ the animal's internal respiratory controller and sensory mechanisms to determine his own physiological needs such as flow rate, tidal volume and breathing frequency. The system then senses incipient respiratory excursions by the animal and provides him with his anticipated demand. Studies on the systems included engineering performance tests, simulated animal tests, analysis of controllability and stability, and in-vivo animal tests. Results from engineering tests and in-vivo animal experiments indicate that demand regulation in liquid breathing provides an effective method for delivering oxygenated liquid to an animal while maintaining physiologically safe blood CO2 and O2 levels. Dissert. Abstr.

N73-21977# National Bureau of Standards, Washington, D.C. Technical Analysis Div.
PROJECT SOAP: A SYSTEMS APPROACH TO BIOMEDICAL RESEARCH PROGRAM MANAGEMENT, A CASE STUDY Final Report
Robert S. Cutler Apr. 1973 74 p refs
(NBS Proj. 4310900)
(NBS-TN-761) Avail: SOD $0.95 domestic postpaid or $0.70 GPO Bookstore as C13.46:761
A description is made of the activities of an interagency task group that applied systems analysis to improve management controls within a biomedical research agency of the federal government. The results were the formulation and implementation

of a discipline for program management which explicitly makes use of multiple criteria in arriving at resource allocation decisions. The text details the necesssry preliminary analysis describing operational activities, information flows, and key decision points within the organization. It goes on to identify the techniques employed and the difficulties encountered while attempting to improve the decision-making process for selecting research projects, under conditions of reduced funding. A procedure which organizes relevant information for research program planning and evaluation is presented, and extension of this recommended procedure to wider use by science administrators elsewhere in government is discussed. Author

N73-21978# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
CORRELATION OF IN SITU FLUORESCENCE AND BIOLUMINESCENCE WITH BIOTA IN THE NEW YORK BIGHT
W. G. Egan and J. M. Cassin Feb. 1973 26 p refs Submitted for publication Prepared in cooperation with Adelphi Inst. of Marine Sciences
(RM-568J) Avail: NTIS HC $3.50

A series of measurements emphasizing the in situ aspects of bioluminescence and fluorescence photometric observations are described. Observations indicate that the causative organisms may be inferred by comparing their in situ bioluminescence, short-wavelength ultraviolet-produced fluorescence, and long-wavelength ultraviolet-produced fluorescence with the laboratory determined biota distribution. Using this approach, it was found that strong bioluminescence occurs above the thermo/halicline and appears to be caused mainly by Peridiniaceae and Gymnodiniaceae. Furthermore, the approach used is neither handicapped by collection nor time lapse problems: It is well suited to long-term monitoring of estuarine areas. Author

N73-21979*# Catholic Univ. of America, Washington, D.C. Dept. of Biology.
GENETIC AND METABOLIC VARIABILITY IN AUTOTROPHIC AND HETEROTROPHIC BACTERIA Final Report, 1 May 1965 - Oct. 1972
B. T. DeCicco Oct. 1972 5 p refs
(Grant NGR-09-005-022)
(NASA-CR-130807) Avail: NTIS HC #.00 CSCL 06M

The studies to evaluate an organism's ability to maintain normal physiological activities over a long period of time in a bioregenerative system are presented. Studies reviewed include: heat tolerant mutants of Pseudomonas fluorescens, virulence factors of the Staphylococci, and the effect of mutations on the virulence for man in common and ubiquitous microorganisms. F.O.S.

N73-21980*# University of Southern Calif., Los Angeles. Environmental Physiology Labs.
OBSERVATION OF ARTERIAL BLOOD PRESSURE OF THE PRIMATE Final Report
J. P. Meehan and J. P. Henry 9 Jan. 1973 77 p refs
(Contract NSR-05-018-087)
(NASA-CR-131890; USC-53-5137-1449) Avail: NTIS CSCL 06C

The developments are reported in physiological instrumentation, surgical procedures, measurement and data analysis techniques, and the definition of flight experiments to determine the effects of prolonged weightlessness on the cardiovascular system of subhuman primates. The development of an implantable telemetric data acquisition system is discussed along with cardiovascular research applications in renal hemodynamics. It is concluded that the implant technique permits a valid interpretation, free of emotional response, for the manipulated variable on physiological functions. It also allows a better definition of normal physiological baseline conditions. F.O.S.

N73-21981*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF AVIATION MEDICINE
G. L. Komendantov, ed. Washington Mar. 1973 177 p refs Transl. into ENGLISH of the Journal "Voprosy Aviatsionnoy Meditsiny" Moscow, v. 143, 1970 177 p NASA
(Contract NASw-2037)
(NASA-TT-F-687) Avail: NTIS HC $3.00 CSCL 06E

Functional physiological diagnostic methods to detect pathological processes that affect flight fitness and selection of flying personnel are reported. Considered are effects of acceleration, barotrauma, aging, hypoxia, and biorhythm disturbances. For individual titles, see N73-21982 through N73-22001.

N73-21982* Techtran Corp., Glen Burnie, Md.
ANALYSIS OF THE MECHANISM OF INTEROCEPTIVE REFLEXES IN ALTITUDE METEORISM
M. D. Chirkin *In its* Probl. of Aviation Med. Mar. 1973 p 1-14 refs (For availability see N73-21981 13-04)
CSCL 06E

Mechanisms of interoceptor reflexes during high altitude meteorisms are analyzed. The effects of pharmaceutical preparations on these mechanisms are discussed in detail, together with the EKG findings pertinent to these mechanisms and the conditions associated with them under the effect of extremal actions. Both respiratory and circulatory manifestations in the major organs (hollow organs) are considered. Author

N73-21983* Techtran Corp., Glen Burnie, Md.
THE EFFECT OF INCREASED PRESSURE IN THE CAVITIES OF THE ALIMENTARY TRACT ON EVOKED REFLEXES. REPORT 1: THE EFFECT ON CALORIC NYSTAGMUS
G. L. Komendantov *In its* Probl. of Aviation Med. Mar. 1973 p 15-24 refs (For availability see N73-21981 13-04)
CSCL 06P

The effect of increased pressure in the alimentary tract on evoked reflexes is considered. High altitude meteorisms are investigated using rabbits or tests by surgical severing of the ocular muscles in these animals, coupled with myograph investigations while the animals are maintained in a pressure chamber. The findings indicate that with an increase in pressure in the alimentary tract to 40 - 50 mm Hg, there is a clearly defined decrease in the caloric nystagmus, with a change in the amplitude ratio of the primary antagonistic muscles of the eyes. Author

N73-21984* Techtran Corp., Glen Burnie, Md.
THE EFFECT OF INCREASED PRESSURE IN THE CAVITIES OF THE ALIMENTARY TRACT ON EVOKED REFLEXES. REPORT 2: THE EFFECT ON PROPRIOCEPTIVE CERVICAL AND LUMBAR COMPENSATORY REFLEXES
G. L. Komendantov *In its* Probl. of Aviation Med. Mar. 1973 p 25-30 refs (For availability see N73-21981 13-04)
CSCL 06P

Changes occurring in the cervical ocular reflexes and in the lumbar ocular reflexes following an increase in gastric pressure were studied. The lumbar reflexes were subject to the most pronounced after effect. The pressure increase caused greater changes in the cervical ocular reflexes. It was concluded that all reflexes were affected to some extent. Author

N73-21985* Techtran Corp., Glen Burnie, Md.
CHANGES OF THE AUTOMATISM, EXCITABILITY AND CONDUCTIVITY OF THE MYOCARDIUM IN HYPOXIC HYPOXIA
V. I. Alifanov *In its* Probl. of Aviation Med. Mar. 1973 p 31-38 ref (For availability see N73-21981 13-04)
CSCL 06P

Myocardial changes in hypoxic hypoxia are studied, primarily with regard to automatism, excitability and conductivity. The WPW syndrome in healthy persons subjected to hypoxia is discussed as it is manifested at various altitude levels. EKG and graphic studies illustrate the physiological changes in otherwise normal persons. Author

N73-21986* Techtran Corp., Glen Burnie, Md.
THE KINEMATICS OF CARDIAC CONTRACTIONS IN HEALTHY PERSONS AND PATIENTS DURING HYPOXIC HYPOXIA
V. I. Alifanov *In its* Probl. of Aviation Med. Mar. 1973 p 39-43 (For availability see N73-21981 13-04)
CSCL 06P

The kinematics of the cardiac systole in otherwise healthy and ill persons during hypoxic hypoxia are discussed. 1,882 persons were investigated at an altitude of 5,000 meters and 264 persons while breathing an hypoxic atmosphere. The Blumberger polycardiographic method was used. Findings indicate

regular systolic changes in both groups. EKG recordings appear in photographs. Author

N73-21987* Techtran Corp., Glen Burnie, Md.
VISCOELASTIC PROPERTIES OF ARTERIES IN CONDITIONS OF REDUCED PARTIAL OXYGEN PRESSURE IN THE INHALED AIR
V. M. Murayenko *In its* Probl. of Aviation Med. Mar. 1973 p 44-51 refs (For availability see N73-21981 13-04)
CSCL 06P

Flight personnel falling into three groups: healthy, ill with hypertonic disease in the 1st stage, and ill with arteriosclerosis of the coronary artery (1st stage) was examined. It was found that changes in these groups were basically within the elastic properties of both types of arteries in that the elasticity coefficient changed only in the elastic arteries in the ill subject. Author

N73-21988* Techtran Corp., Glen Burnie, Md.
THE EARLY RECOGNITION OF LATENT CORONARY INSUFFICIENCY IN FLIGHT PERSONNEL WITH THE AID OF COMBINED FUNCTIONAL LOADING
L. M. Lemesheva *In its* Probl. of Aviation Med. Mar. 1973 p 52-55 refs (For availability see N73-21981 13-04)
CSCL 06P

Early recognition of latent coronary insufficiency in flight personnel during combined functional loading in a pressure chamber is reported. EKG results indicate that the function loading EKG analysis method is useful in identifying LCI. Author

N73-21989* Techtran Corp., Glen Burnie, Md.
CHANGES IN VECTOR CARDIOGRAMS AFTER GLUCOSE TESTS IN CIVIL AVIATION FLIGHT PERSONNEL WITH ATHEROSCLEROSIS
Ye. I. Kuznetsova *In its* Probl. of Aviation Med. Mar. 1973 p 56-58 refs (For availability see N73-21981 13-04)
CSCL 06P

Changes which occur in vector cardiograms after glucose testing of flight personnel are reported. Findings on the EKG are that glucose testing causes changes in the vector cardiograms. Author

N73-21990* Techtran Corp., Glen Burnie, Md.
METHOD OF TONE AND SPEECH AUDIOMETRY IN THE MEDICAL EXAMINATION OF FLIGHT PERSONNEL
V. M. Kozin *In its* Probl. of Aviation Med. Mar. 1973 p 59-78 refs (For availability see N73-21981 13-04)
CSCL 06E

A method of tone and speech audiometry in the medical examination of flight personnel is reported that utilizes audiometers to test subthreshold audio values as well as audibility boundary sounds. Channel audiometers and important test conditions such as room acoustics and masking are discussed. The method discussed is not new, but rather a combined application of several previously used techniques. Audiograms are included. Author

N73-21991* Techtran Corp., Glen Burnie, Md.
MEDICAL OBSERVATIONS OF FLIGHT PERSONNEL SUFFERING FROM MANIFESTATIONS OF ARTERIAL HYPERTENSION
V. Z. Mokhov *In its* Probl. of Aviation Med. Mar. 1973 p 79-84 (For availability see N73-21981 13-04)
CSCL 06E

Symptoms of arterial hypertension in flight personnel are discussed. Findings indicate that 5% of flight personnel aged 39-49 suffer from arterial hypertensions. A group aged 29 to 37 was investigated. All were overweight and all had arterial hypertension; one horizontal coronary axis and three insignificant ventricular myocardial changes were found. Pulse and arterial pressure changes in various flight conditions are shown. Author

N73-21992* Techtran Corp., Glen Burnie, Md.
CHANGES OF COMPENSATORY PROPRIOCEPTIVE EVOKED REFLEXES DURING HYPOXIA
G. L. Komendantov *In its* Probl. of Aviation Med. Mar. 1973 p 85-96 refs (For availability see N73-21981 13-04)
CSCL 06P

The ocular and third eyelid muscles of rabbits were the subjects of the investigation. 68 rabbits were tested in a pressure chamber at an altitude of up to 11,000 meters for 1 to 58 minutes. It was found that the evoked reflexes were highly resistant to hypoxically caused changes; restoration of altered reflexes occurred. Hypoxic ocular nystagmus was registered in high altitude conditions. Author

N73-21993* Techtran Corp., Glen Burnie, Md.
PROBLEMS OF BLOOD CIRCULATION BIOPHYSICS DURING HYPERBARIC OXYGEN BREATHING
V. N. Alifanov *In its* Probl. of Aviation Med. Mar. 1973 p 97-105 refs (For availability see N73-21981 13-04)
CSCL 06P

Changes in the blood circulation (biophysical) during oxygen breathing at high altitudes were investigated in 418 persons of various ages and states of health. Changes were found in the peripheral vascular resistance primarily. It was concluded that constant oxygen percentage up to 200 mm Hg can be safely used as a diagnostic test of flight personnel. Author

N73-21994* Techtran Corp., Glen Burnie, Md.
CONDITIONED-REFLEX MOTION SICKNESS AS A METHOD OF EVALUATING THE STATOKINETIC RESISTANCE OF THE FLIGHT PERSONNEL
V. S. Kompanets *In its* Probl. of Aviation Med. Mar. 1973 p 106-110 refs (For availability see N73-21981 13-04)
CSCL 06P

A criterion of conditioned reflex motion sickness is considered for evaluating statokinetic resistance in flight personnel. Findings indicate that conditioned reflex motion sickness is a valid criterion in testing for air sickness. Author

N73-21995* Techtran Corp., Glen Burnie, Md.
ACCELERATION DURING DOUBLE ROTATION IN THE BARANY CHAIR
N. A. Razsolov and A. M. Rukavishnikov *In its* Probl. of Aviation Med. Mar. 1973 p 111-116 refs (For availability see N73-21981 13-04)
CSCL 06P

Acceleration during double rotation in a Barany chair for eliminating unsuitable applicants from flight and spaceflight duty is considered. Formulae accompany the text, as do illustrations, to indicate method and parameters. Effects of rotation on the semicircular canal and the vestibular apparatus in a rolling sensation was experienced by some subjects. Author

N73-21996* Techtran Corp., Glen Burnie, Md.
MECHANISMS OF DISTURBANCE OF THE THERMOREGULATING FUNCTION OF THE ORGANISM UNDER REDUCED BAROMETRIC PRESSURE
I. I. Antonov *In its* Probl. of Aviation Med. Mar. 1973 p 117-122 refs (For availability see N73-21981 13-04)
CSCL 06P

Disturbances of the thermo-regulating function of an organism in conditions of reduced barometric pressure are analyzed. It is concluded that hypothermia results from an inbalance of heat production and heat dissipation. Author

N73-21997* Techtran Corp., Glen Burnie, Md.
A STUDY OF THE DIURNAL FLUCTUATIONS IN THE CARDIAC RHYTHM AS ONE OF THE EARLY SYMPTOMS OF FUNCTIONAL INSUFFICIENCY OF THE CARDIOVASCULAR SYSTEM
M. S. Kaybyshev *In its* Probl. of Aviation Med. Mar. 1973 p 123-131 refs (For availability see N73-21981 13-04)
CSCL 06P

Diurnal fluctuations of the cardiac rhythm are considered symptomatic of functional insufficiency of the cardic vascular system in flight personnel. It is concluded that the entire syndrome of functional changes need be evaluated to diagnose early functional insufficiency on this basis. Author

N73-21998* Techtran Corp., Glen Burnie, Md.
THE EXPERIMENTAL TREATMENT OF POISONINGS WITH A NEW ORGANOPHOSPHORIC INSECTICIDE (METHYLNITROPHOS) WITH THE USE OF CHOLINESTERASE REACTIVATORS
V. N. Razsudov *In its* Probl. of Aviation Med. Mar. 1973 p 132-138 refs (For availability see N73-21981 13-04)

CSCL 06E

An experimental treatment of poisoning (a new insecticide: methylnitrophos) using cholinesterase reactivators is reported. Two types of reactivators were tested; 2-PAM-chloride and TMB-4 in various doses. TMB-4 was the more effective, even in smaller doses. Tables and graphs are included. Author

N73-21999* Techtran Corp., Glen Burnie, Md.
AGE RESTRICTIONS IN CIVIL AVIATION
V. P. Yerokhin *In its* Probl. of Aviation Med. Mar. 1973 p 139-156 refs (For availability see N73-21981 13-04)
CSCL 06P

Electrocardiograms and other physical tests were made on flight personnel in order to study age restrictions in civil aviation. It was found that of the two groups tested, the elder performed at a higher level of efficiency and with acceptable physiological parameters. Author

N73-22000* Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF BAROTRAUMA OF THE MIDDLE EAR
R. A. Medvezhova *In its* Probl. of Aviation Med. Mar. 1973 p 157-161 refs (For availability see N73-21981 13-04)
CSCL 06P

Pressure damage to the middle ear in 74 cases of pressure trauma was studied. It was found that pressure trauma can be most serious with respect to reducing work capability of personnel in flight, and that pressure trauma of the middle ear developed with acute rhinitis. Author

N73-22001* Techtran Corp., Glen Burnie, Md.
SOME PHYSIOLOGICAL REACTIONS IN PILOTS DURING TRAINING AND DURING FLIGHT
V. P. Yerokhin and V. F. Ostrovskiy *In its* Probl. of Aviation Med. Mar. 1973 p 162-167 (For availability see N73-21981 13-04)
CSCL 06P

The physiological reactions of pilots in training and during flight are studied. It is found that the vegetative indicators are identical in real and simulated flight and that flight training can be used to spot pilots who are unfit for duty. Author

N73-22002# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND MEDICINE, VOLUME 6, NO. 4, 1972
29 Sep. 1972 152 p refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina, Vol. 6, No. 4, 1972" Moscow, Meditsina Publishing House
(JPRS-57139) Avail: NTIS HC $9.75

The safety of long space flight for humans is studied by evaluating environmental effects on the physiological responses of man. Stresses induced by weightlessness, controlled atmospheres and hypokenesia are emphasized. For individual titles, see N73-22003 through N73-22022.

N73-22003 Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL CHANGES IN THE SUPRARENALS OF RATS DURING HYPOKINESIA
I. L. Yurgens and O. I. Kirillov *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 1-6 refs (For availability see N73-22002 13-04)

Male rats of the Wistar strain weighing 95-100 g were kept in boxes. Control and experimental animals were killed 12 hours, 2, 5, 9, 14 and 19 days after their enclosure. Under hypokinetic conditions the weight of the suprarenals increased due to an enlargement of the fascicular zone. At later experimental times hypertrophy of the suprarenals decreased whereas dystrophy developed. The size of the nuclei increased in all zones in the experimental rats. This was very distinct in animals killed 12 hours and 2 days after the beginning of the experiment. As dystrophy increased, hypertrophy of the nuclei decreased, the dropoff being greater in the inner than in the outer parts.
Author

N73-22004 Joint Publications Research Service, Arlington, Va.
EFFECT OF A HIGH OXYGEN CONTENT ON THE INTENSITY OF FORMATION AND ELIMINATION OF SOME GASEOUS PRODUCTS OF VITAL FUNCTIONS BY RATS
B. I. Abidin, V. V. Kustov, T. A. Lekareva, K. P. Bugar, L. T. Poddubnaya, and V. I. Belkin *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 7-11 refs (For availability see N73-22002 13-04)

It was demonstrated that 2-day exposure of albino male rats to a hyperoxic atmosphere at normal barometric pressure increased the formation and elimination of carbon monoxide and decreased the elimination of ammonia. Author

N73-22005 Joint Publications Research Service, Arlington, Va.
THE MECHANISM OF ADAPTATION TO HYPOXIC HYPOXIA
V. I. Dedukhova, Ye. V. Loginova, V. B. Malkin, Ye. N. Mokhova, and N. A. Roshchina *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 12-19 refs (For availability see N73-22002 13-04)

A comparison is presented of the indices of tissue respiration and cerebral morphology with physiological indices characterizing the degree of altitude adaptation in rats. Hemoglobin concentration, the number of erythrocytes in peripheral blood, changes in tolerance to acute hypoxia, and oxygen consumption are observed under conditions of normal and reduced barometric pressure.
G.G.

N73-22006 Joint Publications Research Service, Arlington, Va.
TIME OF RETENTION OF INCREASED RESISTANCE TO HYPOXIA IN RELATION TO DIFFERENT PATTERNS OF HIGH MOUNTAIN ACCLIMATIZATION
M. M. Mirrakhimov, A. A. Aydaraliyev, and M. D. Dzhunushev *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1973 p 20-26 refs (For availability see N73-22002 13-04)

The altitude ceiling of albino rats was investigated in relation to their acclimatization in mountains. The animals were kept 15, 30, 45 and 60 days in the mountains and their altitude ceiling was estimated on the 3d, 10th, 20th, 30th, 40th and 60th days. This altitude ceiling reached the maximum level by the 45th to 60th day. Following 15- and 30-day acclimatizations, increased resistance to acute hypoxia persisted for 20 to 30 days and approximated the background level by the 40th day. The animals which were acclimatized for 45 and 60 days retained increased resistance to acute hypoxia during 60 days in lower altitudes. Author

N73-22007 Joint Publications Research Service, Arlington, Va.
EFFECT OF PRELIMINARY EXPOSURE TO CARBON MONOXIDE ON DEVELOPMENT OF HYPOKINETIC DISORDERS IN WHITE RATS
V. V. Kustov, B. I. Abidin, V. I. Belkin, and L. T. Poddubnaya *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1973 p 27-32 refs (For availability see N73-22002 13-04)

It was demonstrated physiologically and biochemically that preliminary exposure of albino rats to carbon monoxide with a concentration of 0.6 plus or minus 0.02 mg/liter insignificantly enhanced the development of hypokinetic disturbances. Author

N73-22008 Joint Publications Research Service, Arlington, Va.
EFFECT OF X-RADIATION IN A DOSE OF 25 AND 250 R ON TRANSPLANTATION IMMUNITY IN MICE CHARACTERIZED BY WEAK AND STRONG HISTOINCOMPATIBILITY SYSTEMS
P. Cherski, P. Korda, V. Kurnatovski, V. Novakovski, T. Obara, and Ya. Vengel *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 33-36 refs (For availability see N73-22002 13-04)

Histocompatibility of mice skin transplants was improved by X-ray irradiation dose of 25 R. It was concluded that reactions of the regional lymph note and the duration of the viability of the skin transplant provide a good model for studying the influence of low ionizing radiation doses on cell immunity. G.G.

N73-22009 Joint Publications Research Service, Arlington, Va.
EVALUATION OF THE FUNCTIONAL STATE OF GRANULOCYTOPOIESIS USING A PYROGENAL TEST
E. S. Zubenkova and B. A. Markelov *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 37-41 refs (For availability see N73-22002 13-04)

The response of healthy dogs to intramuscular injection of pyrogenal in a dose of 1 microgram/kg of body weight is described.

The response is characterized by transient leukopenia, followed by marked leukocytosis because of ejection of granulocytes from the bone marrow. It is simultaneously accompanied by an insignificant absolute and relative lymphopenia and eosinopenia.
Author

N73-22010 Joint Publications Research Service, Arlington, Va.
THIRTY DAY EXPERIMENT WITH SIMULATION OF THE PHYSIOLOGICAL EFFECTS OF WEIGHTLESSNESS
A. M. Genin and L. I. Kakurin *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 42-44 (For availability see N73-22002 13-04)

The use of a hypodynamic weigthlessness model with an antiorthostatic position of the human body is reported. The weightlessness effect is expressed in the appearance of blood flow sensations to the head, hyperemia and some pastiness of the face, and appearance of the illusion of an overturned position when the eyes are closed. These phenomena are accompanied by changes in blood redistribution.
G.G.

N73-22011 Joint Publications Research Service, Arlington, Va.
ORGANIZATION OF THE EXPERIMENTS AND OVERALL CONDITION OF THE SUBJECTS
A. D. Voskresenskiy, B. B. Yegorov, I. D. Pestov, S. M. Belyashin, V. M. Tolstov, and I. S. Lezhin *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 45-51 refs (For availability see N73-22002 13-04)

Changes in health of 15 male test subjects confined to a rigorous bed rest regime were studied. During a 30-day experiment six subjects remained in a recumbent position and nine remained in an antiorthostatic position. Daily application of 6-hour negative pressure on the lower part of the body during recumbent bed rest was followed by the appearance of overtraining symptoms, decrease of tolerance and distinct general asthenization. Application of negative pressure on the lower part of the body during only the 26th-30th days in a recumbent position affected the test subjects favorably. During the first hours of hypokinesia the subjects who were in an antiorthostatic position developed symptoms associated with blood rushing to the head. The adaptation took place over a period of 2 days, although some symptoms persisted for 2 weeks.
Author

N73-22012 Joint Publications Research Service, Arlington, Va.
CHANGES IN CEREBRAL, PULMONARY AND PERIPHERAL BLOOD CIRCULATIONS
Kh. Kh. Yarullin, T. N. Krupina, T. D. Vasilyeva, and N. N. Buyvolova *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 52-61 refs (For availability see N73-22002 13-04)

The state of cerebral, pulmonary and peripheral circulation was examined rheographically in nine test subjects during a 30-day bed rest experiment in which the head was tipped downward at an angle of 4 deg. Certain phases in changes of regional circulation were detected. Rheographic symptoms of increased arterial influx and venous congestion in the brain and lungs observed during the first experimental week were accompanied by feelings of blood rushing to the head, heaviness in the head, and facial reddening. Later the symptoms of arterial and venous hypotension decreased, especially in the brain, but increased in the shin.
Author

N73-22013 Joint Publications Research Service, Arlington, Va.
VARIATIONS IN CARDIAC OUTPUT AND GAS EXCHANGE AT REST DURING HYPOKINESIA
Yu. D. Pometov and B. S. Katkovskiy *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 62-73 refs (For availability see N73-22002 13-04)

A 30-day bed rest experiment was carried out during which six healthy male test subjects remained in a horizontal position and nine rest subjects were in an antiorthostatic position. Variations in hemodynamics and gas exchange as related to basal metabolism were studied. The subjects who were confined strictly to bed revealed a significant decrease in gas exchange, regardless of whether they were horizontal or antiorthostatic. Subjects who performed physical exercises or underwent electric muscle stimulation exhibited a smaller dropoff of the parameters.
Author

N73-22014 Joint Publications Research Service, Arlington, Va.
STATE OF THE VISUAL ANALYZER UNDER HYPOKINETIC CONDITIONS
N. T. Drozdova and Ye. P. Grishin *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 74-78 (For availability see N73-22002 13-04)

During a 30-day bed rest experiment close and distant visual acuity was measured and ophthalmoscopic, photocalibrometric and ophthalmodynamometric examinations were performed with subjects who were in an antiorthostatic position. Beginning with the fourth to fifth day of hypokinesia their visual acuity, especially at close range, decreased substantially. Hemodynamic shifts were more distinct in those test subjects who were subjected to no preventive measures. In two cases perivasal and peripapillary edema of the retina was found. The mentioned changes exerted no significant effect on visual performance of the subjects. The above mentioned shifts disappeared when they started to work actively.
Author

N73-22015 Joint Publications Research Service, Arlington, Va.
STUDY OF REACTIONS OF HUMAN OTORHINOLARYNGOLOGICAL ORGANS DURING HYPOKINESIA
I. Ya. Yakovleva, V. P. Baranova, L. N. Kornilova, and M. V. Nefedova *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 79-87 refs (For availability see N73-22002 13-04)

The functional state of otorhinolaryngological organs during a 30-day antiorthostatic bed rest experiment was studied on three groups of three men each. The subjects in the first group performed physical exercises while remaining in bed, those in the second group were used as controls and the subjects in the third group were subjected to electric muscle stimulation. Dynamic rhinopneumomentry revealed increased blood filling of the vessels in the nasal mucosa and lability of their tone in the test subjects of all three groups, the highest level being noted in the controls. Audiometric examinations revealed similar changes in the functions of loudness and ototopics in all test subjects. Test subjects exhibited the greatest errors in spatial perception during the first hours of hypokinesia.
Author

N73-22016 Joint Publications Research Service, Arlington, Va.
PULMONARY VOLUMES OF HUMAN SUBJECTS RESTRICTED TO AN ANTIORTHOSTATIC POSITION WITH APPLICATION OF DIFFERENT COUNTERACTING AGENTS
B. S. Katkovskiy and V. A. Andretsov *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 88-94 refs (For availability see N73-22002 13-04)

Total lung capacity (TLC) and other pulmonary volumes of nine test subjects were studied during a 30-day bed rest experiment. The subjects were fixed in their beds with the foot end being lifted at an angle of 4 deg to the horizontal. During the first experimental days all the parameters declined appreciably in the test subjects of all three groups. The TLC of test subjects who performed physical exercises remained decreased until the end of the experiment; that of the second control group approximated the pretest level only on the 17th day, remaining still higher to the end of the experiment, and the TLC of test subjects who underwent electric muscle stimulation exceeded the pretest value on the fifth experimental day and continued to increase by the end of the experiment.
Author

N73-22017 Joint Publications Research Service, Arlington, Va.
NEGATIVE PRESSURE ON THE LOWER PART OF THE BODY AS A METHOD FOR PREVENTING SHIFTS ASSOCIATED WITH CHANGE IN HYDROSTATIC BLOOD PRESSURE
I. D. Pestov and B. F. Asyamolov *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 95-102 refs (For availability see N73-22002 13-04)

Four runs of 18-hour (eight test subjects) and 30-day (nine test subjects) simulated weightlessness tests were used to study the relationship between changes in water balance and orthostatic stability, on the one hand, and the degree of decrease in blood hydrostatic pressure. It is shown that it is possible to prevent shifts caused by pressure decrease by means of application of lower body negative pressure.
Author

N73-22018 Joint Publications Research Service, Arlington, Va.
PHYSICAL TRAINING AS A METHOD FOR PREVENTING

THE HYPODYNAMIC SYNDROME
V. I. Stepantsov, M. A. Tikhonov, and A. V. Yeremin *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 103-109 refs (For availability see N73-22002 13-04)

During a 30-day bed rest period an evaluation was made of physical training apparatus and methods used for preventing hypodynamic disturbances. Described is a trainer for simulating a weight load upon the horizontal body and different physical exercises. The efficiency of the physical exercises was evaluated using biomechanical and physiological indices. Calculations of the energy expenditures involved in the physical exercises are included. Author

N73-22019 Joint Publications Research Service, Arlington, Va.
EFFECT OF PHYSICAL TRAINING AND ELECTRIC STIMULATION ON METABOLISM
I. S. Balakhovskiy, V. T. Bakhteyeva, R. V. Beleda, Ye. I. Biryukov, L. A. Vinogradova, A. I. Grigoryev, S. I. Zakharova, I. G. Dlusskaya, R. K. Kiselev, and T. A. Kislovskaya *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 110-116 refs (For availability see N73-22002 13-04)

Metabolic changes developing during bed rest and the possibility of preventing these changes by the use of physical exercises and electric muscle stimulation were investigated. The tested program of physical exercises and electric muscle stimulation were shown to eliminate partially unfavorable bed rest effects. Author

N73-22020 Joint Publications Research Service, Arlington, Va.
CEREBRAL HEMODYNAMICS DURING 120 DAY CLINOSTATIC HYPOKINESIA
A. Ya. Tizul, B. V. Kozlov, and G. V. Ananyev *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 117-123 refs (For availability see N73-22002 13-04)

Rheoencephalography and occlusion orbital and temporal plethysmography are used to examine cerebral hemodynamics in test subjects during 120-day clinostatic bed rest and a 20-day recovery periods. The prolonged bed rest experiment resulted in phasic changes in cerebral circulation which included a reduction in blood filling and a decrease in the tone of cerebral vessels. The peculiar feature of the cerebral circulation parameters was their instability and a wide scatter of their individual variations. The mentioned changes occurred due to lability of nerve centers which control the functioning of the systems responsible for its adaptive dynamics and rearrangement to meet the requirements of a new environment. Author

N73-22021 Joint Publications Research Service, Arlington, Va.
JOINT EFFECT OF STIMULATORS AND TRANQUILIZERS ON PERFORMANCE OF A MAN-OPERATOR
G. D. Glod, V. Ye. Belay, P. V. Vasilyev, and T. A. Orlova *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 124-133 refs (For availability see N73-22002 13-04)

The influence of centerdrine (0.02 g), trioxazine (0.3 g) and their combination on human performance during continuous 2-hour stressful work was studied. It was demonstrated that both drugs improved the performance indices (reaction time, quality of compensatory tracking). The combined use of the drugs yielded a greater effect than the use of either of them separately. The role of emotional reactions in the course of man's professional activity and the mechanism of the favorable effect of drugs on performance are examined. Author

N73-22022 Joint Publications Research Service, Arlington, Va.
DETERMINING COPPER, IRON, COBALT, NICKEL AND MANGANESE IN BIOLOGICAL SAMPLES OF PLANT ORIGIN
N. B. Krotova and A. P. Tereshchenko *In its* Space Biol. and Med., Vol. 6, No. 4, 1972 29 Sep. 1972 p 134-142 refs (For availability see N73-22002 13-04)

The creation of life support systems based on the biological cycling of matter provides for obtained analytical chemistry data on microelements. Direct spectrometric methods are used extensively for determining the content of these elements. Hexamethylenedithiocarbaminate of ammonium hexamethylene (HMA) is recommended as an effective extraction reagent for a quantitative determination of copper, iron, cobalt, nickel and manganese. The extraction of copper (II), iron (II, III), cobalt (II), nickel (II) and manganese (II) in the form of complexes with HMA, as well as a method for extracting and determining these elements in biological objects are described. Author

N73-22023*# Techtran Corp., Glen Burnie, Md.
MECHANISMS OF SLEEP
A. N. Shepovalnikov, ed. Washington NASA Apr. 1973 128 p refs Transl. into ENGLISH of the book "Mekhanizmy Sna" Leningrad, Nauka Press, 1971 Proc. a Symp. held at Leningrad, 14-16 Dec. 1971
(Contract NASw-2037)
(NASA-TT-F-740) Avail: NTIS HC $3.00 CSCL 06P

Electrophysiological recordings of brain waves during the various phases of sleep in man and animals are reported. Dynamic reactivities of the somatosensory cortex during neurotic sleep disruptions, hypnotherapy, vestibular activity, dream sequencies, and neuropathological disorders are observed in sleep and wakefulness states. For individual titles, see N73-22024 through N73-22032.

N73-22024* Techtran Corp., Glen Burnie, Md.
PATHOLOGY OF THE BRAIN AND THE STRUCTURE OF NOCTURNAL SLEEP
A. M. Veyn *In its* Mech. of Sleep Apr. 1973 p 1-8 (For availability see N73-22023 13-04)
CSCL 06P

An electropolygraphic comparison series of the nocturnal sleep of 126 patients with neurological disorders and 10 persons who were normally healthy is reported. Perturbations in sleep duration are noted in various neurological disorders, with alteration in the length of sleep, however, insignificant. In narcolepsy, stage perturbation is noted. Author

N73-22025* Techtran Corp., Glen Burnie, Md.
SEVERAL METHODS FOR COMPARATIVE PHYSIOLOGICAL STUDY OF THE STAGES OF NATURAL SLEEP AND WAKEFULNESS
I. G. Karmanova *In its* Mech. of Sleep Apr. 1973 p 9-12 (For availability see N73-22023 13-04)
CSCL 06P

A comparative study of several of the stages and phases of sleep in fish, amphibians, birds, and reptiles is presented. It was found that the forebrain EEG in birds and mammals differs markedly from that of the other experimental animals. A close functional interrelationship was found between slow wave and paradoxical sleep. Author

N73-22026* Techtran Corp., Glen Burnie, Md.
ELECTROPHYSIOLOGICAL INDICES OF SLEEP IN THE CEREBRAL CORTEX
A. B. Kogan and G. L. Feldman *In its* Mech. of Sleep Apr. 1973 p 13-18 (For availability see N73-22023 13-04)
CSCL 06P

An electrophysiological investigation of the nerve structures in which sleep inhibition develops is discussed. Twenty-four points of the cat's brain were selected for recordings. It was found that the anterior cortex produced delta waves in the initial period of sleep. The waves subsequently spread over the entire cortex. Subsequent investigation reveals similar facts pertinent to other waves in subsequent stages. Author

N73-22027* Techtran Corp., Glen Burnie, Md.
SEVERAL ASPECTS OF THE FUNCTIONAL INTERDEPENDENCE OF DELTA SLEEP AND RADIO SLEEP
K. P. Latash *In its* Mech. of Sleep Apr. 1973 p 19-26 (For availability see N73-22023 13-04)
CSCL 06P

The functional interdependence of delta sleep and rapid sleep was studied; special experiments were performed on animals and people to compare the various stages of deep and slow sleep. It was established that rapid sleep is dependent on a precursor stage of slow sleep. Author

N73-22028* Techtran Corp., Glen Burnie, Md.
SUBCELLULAR CHANGES IN THE MOTOR REGION OF THE CORTEX DURING SLEEP
A. A. Manina and R. P. Kucherenko *In its* Mech. of Sleep Apr. 1973 p 27-30 (For availability see N73-22023 13-04)

CSCL 06P

Subcellular changes in the cortical region of the analyzers during sleep are studied. Neuronal changes under the effect of nembutal and phenobarbital are observed. In this way it is determined that metabolic activities during sleep are the same as during wakefulness. Author

N73-22029* Techtran Corp., Glen Burnie, Md.
THE ORGANIZATION OF THE PROCESS OF SLEEP IN MAN ACCORDING TO THE DATA OF ELECTROPHYSIOLOGICAL INVESTIGATION OF THE DEEP STRUCTURES OF THE BRAIN
N. I. Moiseyeva, Z. A. Aleksanyan, V. V. Belyayev, V. A. Ilyukhina, V. A. Kolesova, and Yu. K. Matveyev *In its* Mech. of Sleep Apr. 1973 p 31-38 (For availability see N73-22023 13-04)
CSCL 06P

The organization of human sleep processes is studied pertinent to the deep structures of the brain. Fifteen patients with implanted electrodes were studied. These patients suffered various neurological disorders. Mapping of somnofunctional regions of the brain resulted from the study. Author

N73-22030* Techtran Corp., Glen Burnie, Md.
THE IMPULSE ACTIVITY OF THALAMIC CELLS IN VARIOUS PHASES OF SLEEP AND WAKEFULNESS
L. M. Mukhametov and Dzh. Rotstsolatti *In its* Mech. of Sleep Apr. 1973 p 39-45 (For availability see N73-22023 13-04)
CSCL 06P

The impulse activity of the thalamic cells in various phases of sleep and wakefulness is reported based on a study of the lateral corpus geniculatum and the caudal part of the reticular nucleus. In the LCG, a realiable variation was found which was absent in the RN. Author

N73-22031* Techtran Corp., Glen Burnie, Md.
THE EFFECTS OF ELECTRICAL ACTIVITY AND EXCITABILITY OF CERTAIN LIMBIC AND MID-BRAIN STRUCTURES DURING VARIOUS PHASES OF SLEEP
T. N. Oniana, Ye. V. Abzianidze, Kapanadze T. K., and M. G. Kavkasidze *In its* Mech. of Sleep Apr. 1973 p 46-52 (For availability see N73-22023 13-04)
CSCL 06P

Mapping of mid-brain and limbic structures in response to excitability during various phases of sleep is reported. Findings with regard to structures and phases are presented in detail. Electrical stimulation is used to rate excitability. Author

N73-22032* Techtran Corp., Glen Burnie, Md.
MATURATIONAL CHANGES IN THE BIOELECTRICAL ACTIVITY OF THE BRAIN IN SLEEPING CHILDREN
A. N. Shepovalnikov and A. A. Savich *In its* Mech. of Sleep Apr. 1973 p 53-57 (For availability see N73-22023 13-04)
CSCL 06P

The maturational physiology of sleep is studied pertinent to changes which occur in the sleep structures and patterns of children in various age and sex groups. The study indicates that the adult type sleep patterns take some months to become established, following birth, and that changes continue to progress well into old age. Author

N73-22033*# Scientific Translation Service, Santa Barbara, Calif.
PROBLEMS OF SPACE BIOLOGY. VOLUME 17: PATHOPHYSIOLOGICAL BASES OF AVIATION AND SPACE PHARMACOLOGY
P. V. Vasilyev, V. Ye. Belay, G. D. Glod, and A. N. Razumeyev Washington NASA Apr. 1973 514 p refs Transl. into ENGLISH of the publ. "Problemy kosmicheskoy biologii. Tom 17: Patofiziologicheskiye Osnovy Aviatsionnoy i kosmicheskoy Farmakologii" Moscow, Nauka, 1971 p 5-323
(Contract NASw-2035)
(NASA-TT-F-736) Avail: NTIS HC $6.00 CSCL 06C

Data on the question of using drugs to increase resistance to the extreme effects of air and space flights are generalized. The possibilities and prospects of using drugs to decrease nervous and emotional tension and fatigue and to increase the work efficiency of pilots and astronauts under specific conditions are discussed. Data are included on the characteristics of the pharmacological effect of drugs during and after the influence of flight factors. Pathophysiological justifications are given for using drugs in aerospace medicine. Author

N73-22034# Webb Associates, Yellow Springs, Ohio.
ANTHROPOMENTRY OF AIR FORCE WOMEN
Charles E. Clauser (AMRL), Pearl E. Tucker (AMRL), Joan A. Reardon (AMRL), John T. McConville, E. Churchill, and Lloyd L. Laubach Wright-Patterson AFB, Ohio AMRL Apr. 1972 1164 p refs
(Contracts F33615-67-C-1772; AF Proj. 7184)
(AD-743113; AMRL-TR-70-5; LC-72-600027) Avail: NTIS HC $60.00 CSCL 05/5

The results are presented of an anthropometric survey of United States Air Force women carried out during 1968. Included in the report are a description of the methods and techniques used in the survey, descriptions--visual as well as verbal--of the measuring techniques used, and both uni- and bi-variate statistical summaries. A total of 137 anthropometric dimensions were measured on a sample of 1,905 U.S. Air Force women: 548 officers or officer trainees and 1,357 enlisted women. This anthropometry included 5 measures of weight and fat thickness, 30 measures of body height and length, 26 measures of body firths, 15 measures of body breadths and depths, and 12 measures of body surface distance. There were, in addition, 30 measures of the head and face, 3 of the hand, and 2 of the feet. Thirteen measurements were remeasures of the subject while she was wearing a foundation garmet. Background data gathered included age, rank, military occupation, birthplace, blood type, and age at menarche. Author

N73-22035# Naval Submarine Medical Center, Groton, Conn.
STUDIES OF CALCIUM AND INORGANIC PHOSPHORUS LEVELS IN PLASMA AND ERYTHROCYTES DURING ACUTE AND CHRONIC HYPERCAPNIA
Elly Heyder 29 Feb. 1972 31 p refs
(AD-749323; SubMedCenter-702; Rept-73-00835) Avail: NTIS HC $3.75 CSCL 06/19

To ascertain the effects of acute and chronic hypercapnia on blood levels of calcium and inorganic phosphorus, guinea pigs were exposed to 1%, 3% and 15% CO2 for various periods up to seven days. Plasma and erythrocyte calcium and inorganic phosphorus and serum ionized calcium were determined. Blood from submariners on FBM patrol, exposed to up to 1% CO2 for three weeks and followed by one week recovery, was analyzed for plasma electrolytes and erthyrocyte calcium. The serum ionized calcium of guinea pigs during acute exposure to each concentration of CO2 shows a pH dependent inverse relationship of a 4.5 to 5% change per 0.1 unit pH change. During the chronic hypercapnia, elevation of total calcium and depression of inorganic phosphorus in these animals exposed to 3% to 15% CO2 would suggest increased parathyroid function. In those guinea pigs exposed to 1% CO2, a depressed total plasma calcium in the presence of increased serum ionized calcium is interpreted as suggesting a possible functional hypoparathyroidism. In the submariners exposed to up to 1% CO2, both total plasma calcium and inorganic phosphorus tended to decrease. Author

N73-22036*# Kanner (Leo) Associates, Redwood City, Calif.
RENIN-ANGIOTENSIN SYSTEM IN SIMULATED HYPERVOLEMIA INDUCED BY IMMERSION
R. Korz, F. Fischer, and C. Behn Washington NASA Apr. 1973 17 p refs Transl. into ENGLISH from Klin. Wochschr. (West Berlin), v. 47, no. 23, 1969 p 1263-1268
(Contract NASw-2481)
(NASA-TT-F-14885) Avail: NTIS HC $3.00 CSCL 06S

The relationship between plasma renin activity, sodium and potassium excretion, and plasma volume was studied during a control period and after immersion in neutral-temperature water (34-34 5 C) for 6 hours. Plasma renin activity decreased by 28%, and the Na/K ratio increased, possibly reflecting decreased aldosterone secretion. Plasma volume decreased by 14.1%; no inverse relationship to plasma renin activity is found. The early natriuretic effect of immersion is concluded to be independent of aldosterone secretion. The early increase in tubular sodium load is considered to cause the decreased renin activity, inducing a reduction in aldosterone secretion, in turn responsible for altered electrolyte excretion after prolonged immersion. Author

N73-22037*# Duke Univ., Durham, N.C. Dept. of Ophthalmology and Psychology.
EFFECT OF ELIMINATION OF NITROGEN AND/OR HYPOXIA OR RESTRICTED VISUAL ENVIRONMENT ON COLOR VISION AND RANGE OF ACCOMMODATION Final Report
Myron L. Wolbarsht, Charles W. White, and W. Banks Anderson, Jr. 28 Feb. 1973 55 p refs
(Contract NAS9-11994)
(NASA-CR-128896) Avail: NTIS HC $4.75 CSCL 06S

The effects upon range of accommodation and color vision of reduced atmospheric pressure, at partial and complete elimination of nitrogen, of hypoxia, and of exposure for varying periods of time to restricted visual environment, have been studied alone or in various combinations. Measurements were made on the electroretinogram, the electrooculogram, and the diameter of the retinal vessels as an indicator of blood flow to the retina at the time of total elimination of nitrogen. An objective method was used to test range of accommodation. In the color vision test the flicker colors of a Benham's top were matched with a colorimeter. Author

N73-22038*# George Washington Univ., Washington, D.C. Biological Sciences Communication Project.
BIBLIOGRAPHY OF SCIENTIFIC PUBLICATIONS AND PRESENTATIONS RELATING TO PLANETARY QUARANTINE: 1966 - 1971
Frank D. Bradley and Marcy R. Nadel Apr. 1973 219 p refs
(Contract NSR-09-010-027)
(NASA-CR-131889; GWU-BSCP-73-10P) Avail: NTIS HC $13.00 CSCL 06M

A bibliography, which is a compilation of citations relating to planetary quarantine, previously listed in similar publications since 1967, is presented to provide a reference for reviewing planetary quarantine research and development. Author

N73-22039*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY QUARANTINE. SPACE RESEARCH AND TECHNOLOGY Semiannual Review, 1 Jul. - 31 Dec. 1972
May 1973 95 p refs
(Contract NAS7-100)
(NASA-CR-131845; JPL-900-608) Avail: NTIS HC $6.75 CSCL 06M

Planetary quarantine strategies for advanced spacecraft consider effects of satellite encounter, Jupiter atmosphere entry, space radiation, and cleaning and decontamination techniques on microbiological growth probability. Analytical restructuring is developed for microbial burden prediction and planetary contamination. G.G.

N73-22040# Defence Research Information Centre, Orpington (England).
THE INFLUENCE OF SIMAZINE ON THE PHOTOSYNTHETIC PIGMENTS OF GREEN ALGAE
L. N. Paromenskeya et al Nov. 1972 12 p refs Transl. into ENGLISH from Fiziol. Rast. (Moscow), v. 15, no. 6, 1968 p 1002-1007
(DRIC-Trans-2992; BR-30358) Avail: NTIS HC $3.00

The amounts of chlorophylls a and b, carotin, lutein and violaxanthin and the chlorophyll luminescence spectra were determined after the incubation for 2, 7 and 17 days of three species of green algae in a medium which either did or did not contain simazine. The pigment content, particularly that of lutein, carotin and chlorophyll a, decreased in the cells of the herbicide sensitive species Chlorella vulgaris and Ankistrodesmus braunii. On the basis of the measurement of the chlorophyll liminescence spectra in suspensions of algae, it was deduced that the observable decrease of chlorophyll with sensitive algae is not directly linked to the interaction of the pigment with simazine. Author (ESRO)

N73-22041# Defence Research Information Centre, Orpington (England).
DECOMPRESSION DISORDERS AFTER EXPOSURE TO SAFE PRESSURE OR SAFE ALTITUDE
M. P. Yelinskii Jan. 1972 9 p refs Transl. into ENGLISH from Voenna-Med. Zh. (USSR), Jul. 1970 p 60-63
(DRIC-Trans-3035) Avail: NTIS

The effects of decompression and altitude sickness on animals and humans are discussed. A review of the literature on the subject shows that the symptoms may occur at depths or altitudes normally considered safe. More detailed investigations are called for. ESRO

N73-22042# Dow Chemical Co., Midland, Mich.
TOXICOLOGICAL EVALUATION OF A BERYLLIUM MOTOR EXHAUST PRODUCT Final Report, 1 Jul. 1970 - 10 Jul. 1972
Howard C. Spencer, Susan B. McCollister, Richard J. Kociba, Charles G. Humiston, and Gary L. Sparschu Wright-Patterson AFB, Ohio AMRL Nov. 1972 109 p refs
(Contract F33615-70-C-1811; AF Proj. 6302)
(AD-756531; AMRL-TR-72-118) Avail: NTIS CSCL 06/20

A sample of an exhaust product collected from a beryllium-fueled NASA-JPL High Energy Upper Stage (HEUS) Motor has been evaluated for its physical and chemical characteristics and biological activity. The physical properties (surface area, crystallinity, average crystallite size, refractive index and density) of the BeO exhaust product more closely resemble those of the higher fired BeO samples than those of active BeO (calcined at 500C). The biological activity was evaluated during a 100-week period following intratracheal administration of the BeO exhaust product to groups of rats in single doses of 50, 10, and 2 mg/kg. Histopathological examination 25, 50, 75 and 100 weeks following treatment revealed a pulmonary response to the BeO exhaust product less severe than that induced by the BeO calcined at 500C, but with lesions similar in nature. Evaluation of tumorigenicity of the BeO exhaust product showed fewer tumors than were found in rats treated with the BeO calcined at 500C. Studies on translocation of beryllium to extrapulmonary tissues (liver, kidney, spleen and bone), conducted 25 and 100 weeks following treatment, showed tissue levels of beryllium from 50 mg/kg BeO exhaust product to be lower than those from 50 mg/kg BeO calcined at 500C. Author (GRA)

N73-22043# SysteMed Corp., Dayton, Ohio.
TOXIC HAZARDS RESEARCH UNIT ANNUAL TECHNICAL REPORT, 1972 Final Report, Jun. 1971 - May 1972
J. D. MacEwen and E. H. Vernot Wright-Patterson AFB, Ohio AFMRL Aug. 1972 166 p refs Sponsored in part by NASA
(Contract F33615-70-C-1046; AF Proj. 6302)
(NASA-CR-131675; AD-755358; W72003; AMRL-TR-72-62) Avail: NTIS HC $10.50 CSCL 06T

The activities of the Toxic Hazards Research Unit (THRU) for the period of June 1971 through May 1972 are reviewed in this report. Acute inhalation toxicity experiments were conducted on hydrogen chloride (HCl) gas and aerosol, ethyl bromide (C2H5Br), hydrogen bromide (HBr), hydrogen sulfide (H2S), ammonia (NH3), chlorine (CL2), and silane (SiH4). Subacute toxicity studies were conducted on chlorine pentafluoride (ClF5), dichloromethane (CH2Cl2) and coal tar volatiles. Further toxicity studies of subacute and chronic responses to inhaled monomethylhydrazine (MMH) are also described. Author (GRA)

N73-22044# Stanford Research Inst., Menlo Park, Calif.
AN INVESTIGATION OF ATMOSPHERIC EFFECTS ON LASER PROPAGATION AND THE IMPACT ON EYE SAFETY Final Report, Jun. 1971 - Oct. 1972
Walter F. Dabberdt Jun. 1972 118 p refs
(Contract F41609-71-C-0029; AF Proj. 7784; SRI Proj. 1341)
(AD-755405) Avail: NTIS CSCL 20/5

Results are presented from an experimental study of laser beam scintillation along a slant path in the atmospheric planetary boundary layer. The primary objective of this research is to determine the influence on eye safety of atmospheric thermal turbulence in causing locally high intensities of energy in laser beams. This work has resulted in the further development of a general eye-hazard evaluation procedure based on atmospheric effects and laser operating conditions. The present work has also resulted in the development of a simple, worst-case guide to estimate the maximum probability of eye damage. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-22045*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

MEDICAL SUBJECT MONITORING SYSTEMS Patent Application

Garry J. Cleveland (Lockheed Missiles and Space Co.), George M. Loh (Lockheed Missiles and Space Co.), Robert S. Luce (Lockheed Missiles and Space Co.), M. I. Lipanovich (Lockheed Missiles and Space Co.), Howard L. Petersen (Lockheed Missiles and Space Co.), Norman Belasco, Sam L. Pool, and Donald W. Mangold, inventors (to NASA) (Boeing Co.) Filed 25 Apr. 1973 24 p

(Contracts NAS9-10742; NAS9-11756)

(NASA-Case-MSC-14180-1; US-Patent-Appl-SN-354406) Avail: NTIS HC $3.25 CSCL 06B

Multichannel subject monitoring systems are described which allow monitored medical subjects freedom of movement. Many types of sensors may be employed and differently arranged. The outputs of the sensors are suitably amplified and conditioned to provide the necessary voltage levels for the multiplexers in the analog-to-digital converters. The measured phenomena are displayed at a remote monitoring and control station. The entire system includes a bio-belt linked by optically coupled transmission and reception links to a data acquisition unit having a central station function of controlling and displaying the output from the bio-belt. NASA

N73-22046*# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

STUDY OF DESIGN AND CONTROL OF REMOTE MANIPULATORS. PART 1: SUMMARY AND CONCLUSIONS

Daniel E. Whitney 15 Feb. 1973 4 p ref

(Contract NAS8-28055)

(NASA-CR-124191; DSR-73784-4-Pt-1) Avail: NTIS HC $3.00 CSCL 05H

The long range objectives of the study of remote manipulators are discussed. The objectives discussed include: static and passive dynamic considerations in manipulator design; active control by man or man-computer combination; and integration of sensors, sensor control and displays. F.O.S.

N73-22047*# Society of Automotive Engineers, Inc., New York. Bioenvironmental Systems Group.

A STUDY OF ALTERNATIVE DESIGNS FOR A SYSTEM TO CONCENTRATE CARBON DIOXIDE IN A HYDROGEN-DEPOLARIZED CELL Final Report

Jan. 1973 26 p refs

(Contract NASw-2439)

(NASA-CR-131868) Avail: NTIS HC $3.50 CSCL 06B

Experimental results are presented on alternative designs for a hydrogen depolarized cell to concentrate CO2 in spacecraft atmospheric control systems. Data cover technical problems, methods for solving these problems, and the suitability of such a cell for CO2 removal and control of atmospheric humidity during the flight mode. E.H.W.

N73-22048*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CHROMATO-FLUOROGRAPHIC DRUG DETECTOR Patent Application

John A. Parker, John Dimeff, and Alvin H. Heimbuch, inventors (to NASA) Filed 25 Apr. 1973 14 p

(NASA-Case-ARC-10633-1; US-Patent-Appl-SN-354611) Avail: NTIS HC $3.00 CSCL 06B

A drug detecting apparatus including a chromatographic system for separating a particular substance from sample solution passed therethrough, is reported. A source of radiation for irradiating the separated substance as it moves through the chromatographic system causes it to fluoresce and emit fluorescent radiation. An optical system spectrally separates the fluorescent radiation according to wavelength the focuses particular portions of the separated spectrum through an exit aperture onto a photodetector. The developed electrical signal commensurate with the intensity of radiation. A recorder responsive to the electrical signal provides an indication of certain characteristics of the substance. NASA

N73-22049# Defence Research Analysis Establishment, Ottawa (Ontario).

SOME RESULTS OF A TEST AT CANADIAN FORCES BASE UPLANDS OF A MEASURE OF WORK AND RESPONSIBILITY

D. R. Hansen Feb. 1973 33 p refs

(DRAE-M45) Avail: NTIS HC $3.75

A pilot study has shown time-span of discretion to be applicable as a measure of military work and responsibility. Based on this measure, the median value of work level for each military rank except three, showed a significant and systematic upward progression with increased rank. The three exceptions proved to be the ones which were either known or suspected to constitute anomalies in the rank structure. The uniformity of the progression of time-span with rank lends support to those who contend that time-span of discretion is the measure used intuitively by everyone to assess level of work. The results of the study indicate that more extensive testing of these methods is merited. Author

N73-22050# Joint Publications Research Service, Arlington, Va.

THE HUMAN FACTOR IN CONTEMPORARY TECHNOLOGY

V. M. Munipov and V. P. Zinchenko 19 Apr. 1973 17 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 11, 1972 p 43-55

(JPRS-58792) Avail: NTIS HC $3.00

An examination was made of the methodological problems of ergonomics. Author

N73-22051# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

THE EFFECT OF LOW VISIBILITY ON THE PERFORMANCE OF VEHICLE OPERATORS

Ronald Liston Aug. 1972 17 p

(AD-749248; CCRL-TR-237) Avail: NTIS HC $3.00 CSCL 05/9

An experimental program to identify the relationship between low visibility conditions and operator performance is discussed. Average speed in negotiating a controlled course is taken as the measure of operator performance. The method to measure visibility is discussed. It is shown that despite use of a contrived test course and artificially reduced visibility, the results appear valid. It is also shown that the relationship between visibility conditions and average speed can be represented with a simple, second order equation. Author

N73-22052# Human Engineering Labs., Aberdeen Proving Ground, Md.

SOME ASPECTS OF INDIVIDUAL DIFFERENCES IN SCHEMATIC CONCEPT FORMATION

Sam H. Lane and Selby H. Evans Mar. 1972 37 p refs

(AD-744781; HEL-TM-9-72; Rept-73-00839) Avail: NTIS HC $4.00 CSCL 05/10

A series of studies is presented in an inital attempt to address issues thought to be related to individual differences in schematic concept formation (SCF). The first two studies were concerned primarily with task development. It was found that a task which required the subject to distinguish pattern from noise demonstrated relatively clear individual differences in learning. The remainder of the studies sought to explore the potential relationship between SCF performance and the traditional individual differences variables of personality, intelligence and race. With regard to personality, no relationship was found between SCF performance and performance on Witkin's Embedded Figures Test. Consistent with previous work, SCF performance was found to be moderately related to traditonal measures of classroom performance (I.Q. and math achievement). It also appeared that some aspects of classroom behavior, as measured by teacher ratings, were related to SCF, but not to I.Q. With regard to the variable of race, preliminary data suggests that the SCF performance of lower socio-economic class black sixth-graders is comparable to that of their white, middle-class counterparts. Author

N73-22053# Human Engineering Labs., Aberdeen Proving Ground, Md.
THE EFFECT OF HELMET FORM ON HEARING: FREE-FIELD THRESHOLDS
R. Bradley Randall and Howard H. Holland Apr. 1972 19 p refs
(AD-745121; HEL-TM-5-72; Rept-73-00842) Avail: NTIS HC $3.00 CSCL 06/17

Audiometric thresholds were determined for 12 subjects under three head conditions: bareheaded; while wearing an M1 helmet, and wearing and experimental helmet. The thresholds were measured for seven tones: 125, 250, 500, 1000, 2000, 4000 and 8000 Hz, at each of five angular orientations. Statistically significant differences were found for all main effects and interactions. The experimental helmet was not significantly different from the bareheaded condition. The high-frequency attenuation characteristics of the M1 helmet were responsbile for the statistically significant differences between head conditions. The differences are of little practical significance, however, since they fall within the range of variation most people experience on a day-to-day basis. Author

N73-22054# Naval Submarine Medical Center, Groton, Conn.
STUDIES IN ENLISTED SUBMARINER MOTIVATION. 1: SOME ETIOLOGICAL FACTORS RELATED TO DEVOLUNTEERING OF SUBMARINE SCHOOL CANDIDATES
Ernest M. Noddin 2 Mar. 1972 14 p refs
(AD-749324; SubMedCenter-703; Rept-73-00836) Avail: NTIS HC $3.00 CSCL 05/10

Questionnaire data pertaining to the circumstances surrounding a submarine crewmember's decision to devolunteer were collected from 101 enlisted men following Submarine School graduation. Thirteen classes of motives resulted from a content analysis of these data. The four major motivational categories in descending order of incidence were: habitability factors, motivation deficiencies, maladjustive indices, and family problems. Habitability factors and motivation deficiencies account for most of the devolunteering of the lower paygrade men assigned to the diesel submarine fleet. In contrast, the higher-rated, nuclear-trained submariners appeared to have devolunteered largely because of problems related to family adjustment, and to a lesser extent, because of the perceived dangers of submarine duty. Across all subgroups within this sample, 25% or more apparently had some type of maladjustive trend associated with and probably casually related to the decision to devolunteer. Several approaches counteractive to the major causes of devolunteering delineated by this study were presented. Author

N73-22055*# Stanford Research Inst., Menlo Park, Calif.
STUDIES TO DESIGN AND DEVELOP IMPROVED REMOTE MANIPULATOR SYSTEMS
J. W. Hill and A. J. Sword Washington NASA Apr. 1973 165 p refs
(Contract NAS2-6680)
(NASA-CR-2238) Avail: NTIS HC $3.00 CSCL 05H

Remote manipulator control considered is based on several levels of automatic supervision which derives manipulator commands from an analysis of sensor states and task requirements. Principle sensors are manipulator joint position, tactile, and currents. The tactile sensor states can be displayed visually in perspective or replicated in the operator's control handle of perceived by the automatic supervisor. Studies are reported on control organization, operator performance and system performance measures. Unusual hardware and software details are described. Author

N73-22056# Human Engineering Labs., Aberdeen Proving Ground, Md.
PERCEPTION OF SYMMETRICALLY DISTRIBUTED WEIGHT ON THE HEAD
R. Douglas Jones, Bernard M. Corona, Paul H. Ellis, R. Bradley Randall, and Hayden A. Scheetz Apr. 1972 13 p refs
(AD-748412; HEL-TN-4-72; Rept-73-00841) Avail: NTIS HC $3.00 CSCL 05/5

Thirty-eight enlisted men, 18 ordnance and 20 infantrymen, judged whether experimentally weighted helmets were heavier, lighter or the same weight as the reference M1 helmet. The findings indicate a lower difference threshold of 2.0 pounds and an upper difference threshold of 3.85 pounds for the combined groups. The Ordnance group's lower difference threshold was 2.25 pounds, while the Infantry group's lower threshold was 1.8 pounds. The upper threshold for the Ordnance group was calculated to be 3.9 pounds, while the Infantry group's upper threshold was 3.8 pounds. The differences were statistically significant. It was concluded that complaints about the present helmet being too heavy are not based on particularly accuracy perception of weight on head and that Infantrymen are not as accurate in their judgments of weight on the head as the soldier with less field experience with the M1 helmet. Author

N73-22057# American Optical Co., Southbridge, Mass. Research Div.
GLASS OCULAR LASER PROTECTIVE FILTERS Final Report, 1 Apr. 1971 - 1 Aug. 1972
Richard F. Woodcock Oct. 1972 35 p refs
(Contract F41609-71-C-0017; AF Proj. 7784)
(AD-755406; TR-619-F) Avail: NTIS CSCL 06/17

The report describes a research study to develop a filter material with an optical density of 4 or greater at 0.694, 1 to 6, and 6 to 10.6 micrometers, but maintaining a luminous transmittance of 50% or better. Prime emphasis was placed on meeting or exceeding the luminous transmittance requirement wherein lies the major benefits as well as the major technical problems. The research included an investigation of the effect on spectral properties of glass compositions prepared with CuO, FeO, rare-earth oxides, various host glass ingredients and various melt conditions; either singly or in combination. The 0.694 micrometer requirement was deleted following a review of the above research program. Melt conditions and composition were finalized for 5-7 kg sized melts and enough melts were made to fabricate 50 pairs of spectacles and 10 plates (6 in. x 6 in.) from this material. The spectacles had an optical density greater than 4 at the desired wavelengths and a luminous transmittance greater than 60%. Author (GRA)

N73-22058# Navy Experimental Diving Unit, Washington, D.C.
INFLUENCE OF INCREASED AMBIENT PRESSURE AND GAS DENSITY ON CARDIAC RATE IN MAN Final Report
Edward T. Flynn, Thomas E. Berghage, and E. Fisher Coil 1 Aug. 1972 40 p refs
(AD-755129; NEDU-4-72) Avail: NTIS CSCL 06/19

Heart rate was measured in ten normal male subjects in a hyperbaric chamber during a two phase study. In phase I graded exercise was performed at ambient pressures of 1.0, 3.27, and 5.45 Ata. At these depths, subject breathed a gas mixture having a density equal to that of the surface (1.0 Ata.) and then gas mixtures having greater densities. In phase II heart rate was recorded during an extended saturation dive. Graded exercise was performed at pressures of 1, 5.54, 10.09, 19.18, and 26.75 Ata. During all these exposures subjects breathed the ambient oxygen, helium, and nitrogen chamber atmosphere. The results of these studies suggest that both the increase in ambient pressure and the increase in inspired gas density contribute to the development of bradycardia under hyperbaric conditions. Author (GRA)

N73-22059# Indiana Univ., Bloomington. Dept. of Anatomy and Physiology.
PHYSIOLOGICAL ADJUSTMENTS TO ENVIRONMENTAL FACTORS Final Report, 1967 - 1972
Reynaldo S. Elizondo, Mukul R. Banerjee, Nelson E. Leatherman, Sherwin Mizell, J. Robert Hippensteele, James Heersma, and Howard H. Rostorfer 13 Dec. 1972 156 p refs
(Contract F44620-68-C-0014; AF Proj. 9562; Proj. THEMIS)
(AD-753913; AFOSR-72-1453TR) Avail: NTIS CSCL 06/19

The report covers the entire scientific effort sustained by Project Themis Contract F44620-68-C-0014 over the 5-year period under the direction of Robert W. Bullard and the year following his death on June 24, 1971. With it are furnished the scientific publications by year, the meetings attended, the abstracts and the review article by Robert W. Bullard. The report also includes the advantages the project has given the department in creating a biophysical approach to physiology, and the advantage to general recruitment of physiologists. The 40 published scientific journal articles adequately summarize the scientific results of this project. Author (GRA)

N73-22924* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EKG ISOLATOR AND CARDIOTACHOMETER SYSTEM
Hubert E. Smith *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 113-117 (For availability see N73-22915 13-34)
CSCL 06B

N73-22925* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FREE FLYING TELEOPERATOR
Herman T. Blaise *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 119-133 (For availability see N73-22915 13-34)
CSCL 05H

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-22060 Rice Univ., Houston, Tex.
ESR STUDY OF SOME GAS PHASE REACTIONS, 1. CONSTRUCTION OF A GAS DISCHARGE FLOW SHOCK TUBE, 2 Ph.D. Thesis
John Eugene Breen, Jr. 1972 156 p
Avail: Univ. Microfilms Order No. 72-26397

The reaction of OH with acetylene was studied in a discharge flow system at room temperature using ESR spectroscopy. Mass-spectrometric analysis of the reaction products yielded the following results: (1) less than 3 molecules of OH were consumed, and less than 2 molecules of H2O were formed for every molecule of acetylene that reacted; (2) CO was identified as the major carbon-containing product, (3) NO, formed in the generation of OH, reacted with a reaction intermediate to give among other products N2O. A mechanism containing the reaction OH + C2H2 + H2 best accounted for the experimental results. Discharge flow techniques were adapted to the conventional shock tube design to allow generation of atoms prior to the formation of the shock front. The shock tube was equipped with quantitative laser schlieren detection and vacuum UV atomic resonance absorption detection. Dissert. Abstr.

N73-22061*# Athens Coll., Ala.
CHEMICAL ANALYSIS OF OUTGASSING CONTAMINANTS ON SPACECRAFT SURFACES
Ronald C. McNutt 26 Mar. 1973 12 p
(Contract NAS8-28058)
(NASA-CR-124227) Avail: NTIS HC $3.00 CSCL 17B

Methods for analyzing and characterizing outgassing contaminants from such materials as RTV 501 potting compound and S 13 G paint are presented. Fractional distillation of a gross distillate from RTV 501 rubber was carried out and the distilled fractions examined as to their ultraviolet and infrared spectra by gas liquid chromatography. A sensitive technique for structural analysis and molecular identification was found to consist of a gas chromatography-mass spectroscopy system, which was determined to be economically unfeasible at present. Author

N73-22062*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYNTHETIC SEA WATER - AN IMPROVED STRESS CORROSION TEST MEDIUM FOR ALUMINUM ALLOYS
T. S. Humphries and E. E. Nelson 21 Mar. 1973 27 p refs
(NASA-TM-X-64733) Avail: NTIS HC $3.50 CSCL 07D

A major problem in evaluating the stress corrosion cracking resistance of aluminum alloys by alternate immersion in 3.5 percent salt (NaCl) water is excessive pitting corrosion. Several methods were examined to eliminate this problem and to find an improved accelerated test medium. These included the addition of chromate inhibitors, surface treatment of specimens, and immersion in synthetic sea water. The results indicate that alternate immersion in synthetic sea water is a very promising stress corrosion test medium. Neither chromate inhibitors nor surface treatment (anodize and alodine) of the aluminum specimens improved the performance of alternate immersion in 3.5 percent salt water sufficiently to be classified as an effective stress corrosion test method. Author

N73-22063# General Electric Co., Santa Barbara, Calif. DASIAC.
REACTION RATE DATA, NO. 37
Nov. 1972 35 p
(Contract DASA01-70-C-0035; DNA Proj. NWER-HD-010)
(AD-756674) Avail: NTIS CSCL 07/4

The report presents summaries of recent progress reports and other informal information of current interest in the reaction rate field. Most of the reports concern upper atmosphere chemistry, metal atom oxidation, or reactions of interest to nuclear fireball studies. GRA

N73-22064# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF CHEMICALLY REACTING GASEOUS SYSTEMS, PART 2
A. K. Krasin 17 Nov. 1972 232 p refs Transl. into ENGLISH of the publ. "Thermodinamicheskie i Perenosnye Svoistva Khimicheski Reagiruyushchikh Gasovykh Sistem" Minsk, 1971 p 1-237
(AD-756597; FTD-HC-23-768-72) Avail: NTIS CSCL 07/4

The theory and method of calculating thermodynamic and transport properties of a real chemically reacting system N2O4 = 2NO2 = 2NO + O2 are explained. The problem of the mechanism of thermal dissociation and radiation-thermal stability of dissociating nitrogen tetroxide is considered. The results of theoretical and experimental investigations on the corrosion resistance of materials in a medium of N2O4 are also presented. A survey of Soviet and foreign literature on the study of the thermophysical characteristics of the system mentioned is given. Analytical dependences, tabular and graphic materials on heat content, enthalpy, density, viscosity, thermal conductivity, and other properties are presented. Author (GRA)

N73-22065# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RHEOLOGICAL PROPERTIES OF AQUEOUS SUSPENSION OF AN ABRASIVE POWDER
M. I. Listopad and N. V. Tyabin 19 Jan. 1973 12 p refs Transl. into ENGLISH from Tr. Konf. Fiz.-Khim. Mekh. Dispersnykh Mater. (Minsk), v. 1, 1970 p 245-249
(AF Proj. 7343)
(AD-756082; FTD-HT-23-1560-72) Avail: NTIS CSCL 07/4

Rheological studies described in the report have shown that suspensions of abrasive powder are viscoplastic media and their rheological constants depend both on the concentration as well as on the degree of dispersion of particles forming the aqueous suspension. Author (GRA)

N73-22066# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT TRANSFER IN CHEMICALLY REACTING GASEOUS HEAT CARRIES
A. K. Krasin, V. B. Nesterenko, A. N. Devoino, B. E. Tverkovkin, A. A. Mikhalevich, and L. I. Kolykhan 10 Jan. 1973 188 p refs Transl. into ENGLISH of the publ. "Teploobmen v Khimicheski Reagiruyushchikh Gazovykh Teplonositelyakh" Minsk, Nauka i Tekhn, 1971 p 1-168
(AD-756095; FTD-MT-24-791-72) Avail: NTIS CSCL 07/4

The report examines questions of convective heat exchange and heat exchange during phase transformations in chemically reacting systems. Considerable attention is given to experimental and design-theoretical research in N2O4 heat exchange. Mathematical models are given for the thermal design of a nuclear reactor and heat exchange instrumentation working with a chemically reacting heat-transfer agent. Author (GRA)

N73-22067# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
DETECTION OF COMBUSTION IMPROVER-2 BY ATOMIC ABSORPTION SPECTROPHOTOMETRY Final Report
E. R. Wright 10 Jan. 1973 10 p refs
(AD-755723; NADC-73009-30) Avail: NTIS CSCL 07/3

The report describes an atomic absorption spectrophotometry

technique for the detection of Combustion Improver-2 in aircraft smoke abatement systems. Author (GRA)

N73-22068# Aerojet Solid Propulsion Co., Sacramento, Calif.
CARBORANE BURNING RATE CATALYSTS Interim Technical Report, 1 Jul. 1971 - 30 Sep. 1972
Ross Fitzgerald and Roger B. Steele 31 Oct. 1972 77 p refs
(Contract F04611-71-C-0066; AF Proj. 3148)
(AD-755379; ASPC-1840-26SA-1; AFRPL-TR-72-114) Avail: NTIS CSCL 07/3

New carborane burning rate catalysts designed for use in solid propellants, without the problems associated with current catalysts, have been prepared. High molecular weight, non-volatile derivatives of bis-(1-carboranylmethyl) ether were synthesized and evaluated for compatibility in hydroxy terminated polybutadiene (HTPB) binders as well as compatibility and ballistic properties in aluminized HTPB-UFAP propellants. The introduction of unsaturation and branched unsaturation into the side chain of bis-carborane derivatives has provided carboranes which are compatible with HTPB binders at high levels and also exhibit a wide liquid range. Thus, undecylenyl-bis-(1-carboranylmethyl) ether was compatible with cured HTPB at the 50% level after storage for six weeks at 77F. The compound 3,7-dimethyl-2,6-octadienyl-bis-(1-carboranylmethyl) ether has exhibited compatibility with cured HTPB at the 57% level. GRA

N73-22069# ARO, Inc., Arnold Air Force Station, Tenn.
A MATHEMATICAL DESCRIPTION OF GAS SURFACE INTERACTION BASED UPON RECIPROCITY Final Report, Jul. 1970 - Jul. 1971
Max Kinslow AEDC Feb. 1973 249 p refs
(Contract F40600-73-C-0004)
(AD-755838; ARO-VKF-TR-72-147; AEDC-TR-72-158) Avail: NTIS CSCL 07/4

The general problem of the interaction between a monatomic gas and a solid surface is investigated from a mathematical point of view by the use of a scattering kernel. This general scattering kernel must fulfill the obvious conditions of normalization and non-negativity and has recently been shown to also satisfy the condition of detailed balancing or reciprocity. It is shown that calculated parameters are related to a tangential and a normal thermal accommodation coefficient. The scattering kernels obtained are integrated, in some cases analytically and others numerically, with various weighting functions in order to obtain mean reflected properties, both global and local, such as molecular flux, speed, and energy. These various results are presented for typical gas-surface interaction parameters. GRA

N73-22070# Nottingham Univ. (England). Dept. of Inorganic Chemistry.
FLOW DECAY Final Scientific Report, 1 Jul. 1970 - 30 Jun. 1972
C. C. Addison 30 Jun. 1972 162 p refs
(Contract F61052-70-C-0035; AF Proj. 3148)
(AD-755378; AFRPL-TR-72-84) Avail: NTIS CSCL 07/2

An investigation of N2O4 adducts of Fe (NO3)3 was carried out, since the compound Fe (NO3)3N2O4 was claimed to be responsible for flow decay of liquid propellant N2O4 in steel systems. Equilibrium vapor pressures of the system Fe (NO3)3: nN2O4 were measured at 10C for values of n between 6.0 and 1.0. The compound Fe(NO3)3:1.5N2O4 is now recognized as the solid phase in equilibrium with liquid N2O4. The presence of HNO3 in N2O4 influences the physical and chemical nature of the flow-decay deposit. The behaviour of Fe (NO3)3:nN2O4 (n = 1.0 to 1.5) in 100% HNO3 and in HNO3/N2O4 and H2O/N2O4 mixtures was therefore studied. The influence of temperature differential on the rate of flow decay was also investigated. Author

N73-22071# Aerojet Liquid Rocket Co., Sacramento, Calif.
FLUORINE SYSTEMS HANDBOOK. SECTION 6: DYNAMIC COMPATIBILITY OF FLUORINE WITH METALS Final Report
Roger E. Anderson Oct. 1972 75 p refs
(Contract F04611-72-C-0031; AF Proj. 5730)
(AD-756908, AFRPL-TR-72-119) Avail: NTIS CSCL 11/6

The document is a special technical report presenting a compilation of all pertinent data and design criteria concerning the dynamic compatibility of fluorine with metals. The information was obtained in the course of the contract which involved both literature search and review and original experimental investigations. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-22072 Pennsylvania Univ., Philadelphia.
DIRECTION SENSITIVE RADAR MOVING TARGET INDICATION Ph.D. Thesis
Harry Urkowitz 1972 282 p
Avail: Univ. Microfilms Order No. 72-25680

The use of directional discrimination (approaching or receding target) in radar moving target indication (MTI) is not usually exploited, but it can provide up to 3 db more detection sensitivity as well as an instantaneous indication of direction of motion. The formal derivation of the optimum direction sensitive receiver begins with the designation of the radar observables. The observables are vectors formed from the sampled values of the complex envelope of the receiver input obtained at intervals equal to the repetition period (assumed constant) corresponding to a specific range or a set of specific ranges. An appropriate criterion for the receiver operation is a likelihood ratio criterion. The likelihood ratio formed from the received vector has several unknown parameters. These are: initial phase, target echo amplitude, target delay (range), and Doppler shift. For each range bin, the likelihood radio is averaged over phase and is formed for each possible or desired value of Doppler frequency shift. This forms a test statistic for each Doppler shift. If this test statistic exceeds a threshold, a target detection is presumed at that range and that Doppler shift. Dissert. Abstr.

N73-22073 Colorado Univ., Boulder.
HIGH-RESOLUTION FOURIER SPECTROSCOPY AND POLARIMETRY OF SOLAR RADIO EMISSION AT 34 MHz Ph.D. Thesis
James Cecil Dodge 1972 158 p
Avail: Univ. Microfilms Order No. 72-25158

Measurements were made of high-resolution spectral and polarization behavior of solar Type 3 bursts at 34 MHz. The polarimeter operated with a total bandwidth of 3 kHz; its output was analyzed by Fourier spectroscopy to approximately 5 Hz resolution. The effects of ground reflections were removed by a parameterization procedure which used galactic background noise as an unpolarized reference. Instrumental amplitude and phase errors were removed digitally. Complete polarization parameters were calculated over approximately 50 Hz bands for time steps of 0.896 sec by averaging the Stokes parameters in the elemental frequency bands. As some Type 3 bursts increased intensity, they showed increasing polarization fractions and progression towards linear polarization in the 50 Hz bands. Dissert. Abstr.

N73-22074 Pennsylvania Univ., Philadelphia.
MATHEMATICAL ANALYSIS OF MILLIMETER WAVE IMAGE CONVERSION SYSTEMS Ph.D. Thesis
Joseph Stanley Jastrzembski 1972 158 p
Avail: Univ. Microfilms Order No. 72-25597

Millimeter wave image conversion systems are used to optically display objects which are obscured by fog or rain. An analysis procedure is developed using the transfer function concept of linear system theory. In this analysis, a two-dimensional transfer function of the image conversion system is derived which relates the spatial frequency spectrum of the millimeter wave image intensity distribution to that of it coverted optical image intensity distribution. The two-dimensional transfer function is reduced to a product of two-dimensional transfer functions for scan spots whose intensity distributions are separable in the x and y direction. These one-dimensional transfer functions are products of subsystem transfer functions which represent such operations as image dissection, electronic processing, and image reproduc-

tion. A computer program is presented which computes the transfer function. Dissert. Abstr.

N73-22075 Cornell Univ., Ithaca, N.Y.
DECIMETRIC SPECTRA OF EXTRAGALACTIC RADIO SOURCES Ph.D. Thesis
James Justin Condon 1972 271 p
Avail: Univ. Microfilms Order No. 72-26341

Flux density measurements of extragalactic sources in samples statistically complete to 9 flux units at 178 MHz, 3 flux units at 430 MHz, 2 flux units at 1400 MHz, and 0.35 flux units at 2700 MHz were made. The principal observing frequency was 318 MHz, where strong confusion-limited observations were made with a 16 arc min beam. A study of the confusion error was made analytically on the basis of Scheuer's method and also statistically by a Monte Carlo simulation, and the 318 MHz flux density errors were found to be only 4 percent plus 0.14 flux units confusion. The spectral index distributions from each sample were tested for flux density dependence. It was found that the median spectral index of the normal spectrum sources in the 2700 MHz sample increases significantly for sources weaker than 0.8 flux units at that frequency. Dissert. Abstr.

N73-22076*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCAN CONVERTING VIDEO TAPE RECORDER Patent Application
Norman I. Holt, inventor (to NASA) Filed 27 Oct. 1971 23 p
Sponsored by NASA
(NASA-Case-NPO-10166-1; US-Patent-Appl-SN-192803) Avail: NTIS HC $3.25 CSCL 14C

A video tape recorder is disclosed of sufficient bandwidth to record monochrome television signals or standard NTSC field sequential color at current European and American standards. The system includes scan conversion means for instantaneous playback at scanning standards different from those at which the recording is being made. NASA

N73-22077*# Southeastern Massachusetts Univ., North Dartmouth. Research Foundation.
AN ALL DIGITAL LOW DATA RATE COMMUNICATION SYSTEM
Chi-Hau Chen and Maisie Fan 12 Mar. 1973 12 p refs
(Grant NGR-22-031-002)
(NASA-CR-130234; EE-73-2) Avail: NTIS HC $3.00 CSCL 17B

The advent of digital hardwares has made it feasible to implement many communication system components digitally. With the exception of frequency down conversion, the proposed low data rate communication system uses digital hardwares completely. Although the system is designed primarily for deep space communications with large frequency uncertainty and low signal-to-noise ratio, it is also suitable for other low data rate applications with time-shared operation among a number of channels. Emphasis is placed on the fast Fourier transform receiver and the automatic frequency control via digital filtering. The speed available from the digital system allows sophisticated signal processing to reduce frequency uncertainty and to increase the signal-to-noise ratio. The practical limitations of the system such as the finite register length are examined. It is concluded that the proposed all-digital system is not only technically feasible but also has potential cost reduction over the existing receiving systems. Author

N73-22078*# Radio Corp. of America, Somerville, N.J. Advanced Communications Lab.
KU-BAND MINIATURE MODULATORS Final Report, 1 Jan. 1972 - 15 Feb. 1973
Robert L. Ernst Mar. 1973 45 p refs
(Contract NAS5-23050)
(NASA-CR-130230) Avail: NTIS HC $4.25 CSCL 17B

Ku-band microminiature modulators were designed to convert a 10 mW signal at 400 MHz to a 10 mW signal at 15 GHz. The designs incorporate gallium arsenide Schottky barrier varactors used in upper-sideband up-converters. The use of Ku-band microstrip circulators and hairpin resonator bandpass filters at 2.1 GHz and 2.5 GHz is included. The design and fabrication of a single up-conversion unit with a double up-conversion unit are compared. Various filter configurations are studies, and the use of both alumina and quartz substrates are considered. The various impedance matching networks are evaluated using computer aided design techniques. Author

N73-22079*# Stanford Univ., Calif. Radioscience Lab.
BANDED WHISTLERS OBSERVED ON OGO-4
Eugene M. Paymar Jan. 1972 53 p refs
(Grant NGR-05-020-288)
(NASA-CR-131495; SU-SEL-71-054; SU-TR-3439-1) Avail: NTIS HC $4.75 CSCL 03B

Inspection of broadband VLF records from OGO-4 shows that some whistlers exhibit a banded structure in which one or more bands of frequencies are missing from the whistler's spectrum. The phenomenon is commonly observed by satellites on midlatitude field lines at all local times and at various longitudes around the world. The dispersion of banded whistlers (BW) is of several tens of sec to the 1/2 power, indicating that they originated in the opposite hemisphere and are propagating downward at the satellite. BW are generally spread in time (tenths of seconds) rather than sharply defined and tend to occur at random. The frequency spacing of the bands may be either uniform or irregular, and may vary radically between successive events. Several possible explanations for BW are considered. In particular, an analysis of the interaction of plane electromagnetic waves traveling in an anisotropic plasma with a field aligned slab of enhanced ionization is presented with promising results. Author

N73-22080*# New Mexico State Univ., University Park. Engineering Experiment Station.
ADVANCED STUDY OF VIDEO SIGNAL PROCESSING IN LOW SIGNAL TO NOISE ENVIRONMENTS Semiannual Progress Report, Jun. - Nov. 1972
Frank Carden and Alton Gilbert Nov. 1972 29 p ref
(Grant NGR-32-003-037)
(NASA-CR-131873) Avail: NTIS HC $3.50 CSCL 17B

The frame to frame correlation properties of the video process are utilized to reduce the mean squared error of the demodulated video where zero mean noise is a factor. An interpolative estimator is used for continuous estimation with the output process delayed in time by one frame. Theoretical development shows that for the model herein developed reduction of the mean squared error by 1.0 to 4.0 db possible for parameter ranges of interest. Interpolative estimation using inter-frame correlation properties of a video process is then applied to the Apollo 17 parameters to yield a model for application on that mission. Author

N73-22081*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 14 Progress Report, Jan. - Feb. 1973
15 Apr. 1973 246 p refs
(Contract NAS7-100)
(NASA-CR-131493; JPL-TR-32-1526-Vol-14) Avail: NTIS HC $14.50 CSCL 17B

DSN progress during Jan. and Feb. 1973 is reported. Areas of accomplishment include: flight project support, TDA research and technology, network engineering, hardware and software implementation, and operations. Author

N73-22082*# Wolf Research and Development Corp., Riverdale, Md. Range Engineering Dept.
GEOS-2 C-BAND RADAR SYSTEM PROJECT. SPECTRAL ANALYSIS AS RELATED TO C-BAND RADAR DATA ANALYSIS Final Report
Oct. 1972 117 p Prepared in cooperation with Radio Corp. of Am., Moorestown, N. J.
(Contracts NAS6-1467; NAS6-1628)
(NASA-CR-62085) Avail: NTIS HC $8.00 CSCL 17I

Work performed on spectral analysis of data from the C-band radars tracking GEOS-2 and on the development of a data compaction method for the GEOS-2 C-band radar data is described. The purposes of the spectral analysis study were to determine the optimum data recording and sampling rates for C-band radar data and to determine the optimum method of filtering and smoothing the data. The optimum data recording and sampling rate is defined as the rate which includes an optimum compromise between serial correlation and the effects of frequency folding. The goal in development of a data compaction method was to reduce to a minimum the amount of data stored,

while maintaining all of the statistical information content of the non-compacted data. A digital computer program for computing estimates of the power spectral density function of sampled data was used to perform the spectral analysis study.
Author

N73-22083*# Wolf Research and Development Corp., Riverdale, Md. Range Engineering Dept.
GEOS-2 C-BAND RADAR SYSTEM PROJECT. MARINE STUDY USING C-BAND RADARS Final Report
Oct. 1972 100 p refs Prepared in cooperation with Radio Corp. of Am., Moorestown, N. J.
(Contracts NAS6-1467; NAS6-1628)
(NASA-CR-62086) Avail: NTIS HC $7.00 CSCL 17I

One of the secondary objectives of the GEOS-2 C-band Systems Project is to study the feasibility of using geodetic satellites to both evaluate shipborne instrumentation and to determine ship positions in broad ocean areas. The purpose of this task is to determine whether shipborne C-band radar tracking, in conjunction with ground based tracking, is sufficiently accurate to provide instrumentation evaluation and ship position estimates. Data from several Apollo tracking ships, in particular the USNS Vanguard, was made available for this effort. A series of tests, using the USNS Vanguard, were carried out in the Port Canaveral and Bahama Acoustic Transponder Array Areas. The major portion of the analyses reported are the result of preliminary investigations using the data from these tests. Author

N73-22084*# Wolf Research and Development Corp., Pocomoke City, Md. Range Engineering Dept.
GEOS-2 C-BAND SYSTEM PROJECT. C-BAND RADARS AND THEIR USE ON THE GEOS-2 PROJECT Final Report
Oct. 1972 158 p Prepared in cooperation with Radio Corp. of Am., Moorestown, N. J.
(Contracts NAS6-1467; NAS6-1628)
(NASA-CR-62087) Avail: NTIS HC $10.00 CSCL 17I

The material presented covers the general topic of C-band radars and their use throughout the GEOS-2 C-band Radar System Project and has direct application to the general problem of gathering accurate radar tracking data. The material is hardware oriented and all analyses and evaluations described pertain to the gathering of accurate data rather than to the application of the gathered data. The radar oriented investigations formed a basic and necessary part of the overall C-band experiment. The successful completion of these efforts led to the definition of how the radars were to be operated and calibrated. These hardware decisions directly affected the quality of the radar data and therefore played a large part in the successful application of these data to geodetic research. Author

N73-22085*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THEORETICAL AND EXPERIMENTAL STUDIES OF REENTRY PLASMAS
M. G. Dunn and Sang-Wook Kang Washington NASA Apr. 1973 115 p refs
(Contract NAS1-10674)
(NASA-CR-2232; CAL-AF-3093-A-2) Avail: NTIS HC $3.00 CSCL 17B

A viscous shock-layer analysis was developed and used to calculate nonequilibrium-flow species distributions in the plasma layer of the RAM vehicle. The theoretical electron-density results obtained are in good agreement with those measured in flight. A circular-aperture flush-mounted antenna was used to obtain a comparison between theoretical and experimental antenna admittance in the presence of ionized boundary layers of low collision frequency. The electron-temperature and electron-density distributions in the boundary layer were independently measured. The antenna admittance was measured using a four-probe microwave reflectometer and these measured values were found to be in good agreement with those predicted. Measurements were also performed with another type of circular-aperture antenna and good agreement was obtained between the calculations and the experimental results. A theoretical analysis has been completed which permits calculation of the nonequilibrium, viscous shock-layer flow field for a sphere-cone body. Results are presented for two different bodies at several different altitudes illustrating the influences of bluntness and chemical nonequilibrium on several gas dynamic parameters of interest. Plane-wave transmission coefficients were calculated for an approximate space-shuttle body using a typical trajectory. Author

N73-22086# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
MLS SYSTEM: DME POWER AMPLIFIER [SYSTEME M.L.S.: D.M.E. CHAINE DE PUISSANCE]
Y. Amblard, J. J. Bonnier, and R. Ermoglio 28 Aug. 1972 17 p In FRENCH
Avail: NTIS HC $3.00

An airborne C-band pulse transmitter was developed for use with an ILS system. Transmitter characteristics include a transmitting frequency of 5067 to 5124 MHz, frequency number of 20 spaced 3 MHz, 1 second switching time, 0.00002 stability, and a 2 kW maximum power, 205 mW average power, 0.66 microsec pulse width, 40 Hz repetition frequency, and a 2 spaced between 10 and 30 microsec pulse number.
Author (ESRO)

N73-22087# Laboratoire Central de Recherches Thomson-CSF, Orsay (France). Lab. Magnetisme.
STUDY OF TRANSMISSION PROPERTIES OF MAGNETO-ELASTIC DELAY LINES Final Report [ETUDE DE DIFFERENTES LIGNES A RETARD MAGNETOELASTIQUES EN TRANSMISSION COMTE-RENDU FINAL]
B. Desormiere 20 Jul. 1971 51 p refs In FRENCH
(Contract DRME-69/34.378.00.480.75.01)
(Rept-8.425) Avail: NTIS HC $4.75

Various magnetoelastic transmission delay lines working in the S-band were investigated. A technique ensuring the acoustic continuity (or transmission) between two different materials is described. A transmission line using the ferrimagnetic crystal acoustic birefringence was realized and its principle and performance characteristics such as insertion loss reduction (36 db at 2.5 GHz for a 3.5 microsec delay) is discussed. ESRO

N73-22088# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires.
MEASUREMENT OF THE POLARIZATION OF RANDOM SIGNALS BY CORRELATION [MESURE PAR CORRELATION DE LA POLARISATION DE SIGNAUX NATURELS]
J. L. Lacoume 16 Oct. 1972 27 p refs In FRENCH Presented at the CNFRS Colloq. on Correlation, Oct. 1972
(CEPHAG-24/72) Avail: NTIS HC $3.50

A critical study of polarization measurement of whistler-type radio of frequency signals, using auto- and cross-correlation functions of the two horizontal signal components, is presented. The method developed is based on the measurement of phase shift between complex signals by correlation, and is equivalent to the classical method of time lag measurement, and thus limited to lower rates of frequency variation. The method permits following the evolution of the polarization of r-f whistlers as a function of frequency, and has a high noise immunity. ESRO

N73-22089# Defence Research Information Centre, Orpington (England).
COMPENSATION OF THE VIDICON SIGNAL DARK COMPONENT
E. P. Tsvetov and V. V. Galushchenko Jan. 1973 10 p refs Transl. into ENGLISH from Tekh. Kino i Telev. (Moscow), v. 7, 1972 p 52-55
(DRIC-Trans-2967; BR-30331) Avail: NTIS HC $3.00

A method is proposed for the compensation of the dark component in the video signal of a vidicon. The method utilizes the fact that in the course of the period of storage the vidicon screen is subjected to an additional changing process at a cathode potential more negative than during the computation period. The method makes it possible to maintain the maximum dynamic range of the video signal computed in the vidicon over long periods of storage and at the same time increase the sensitivity and improve the light transmission. ESRO

N73-22090# California Univ., Santa Barbara.
AUTOMATIC SPEECH PROCESSING Final Report, 1 Jun. - 31 Aug. 1972
Andre Malecot 31 Oct. 1972 11 p
(Contract N00014-69-A-0200-8011; NR Proj. 049-342)
(AD-752811) Avail: NTIS CSCL 17/2

Performance standards for syllabic rate and utterance length in French are established for teaching, linguistic theory and voice processing technology. Variations in these aspects of speech are studied as functions of a number of demographic, psychological, intellecutal and phonetic background parameters. Syllabic rate is found to vary as a function of sex, age, occupation and certain intentions, while utterance length varies as a function of age, occupation, certain intentions, certain attitudes and loudness. Overall rate averages turn out to be strikingly consistent, most speakers showing about 344 syll/min. Finally, a positive correlation exists between utterance length and syllabic rate. Author (GRA)

N73-22091# Harry Diamond Labs., Washington, D.C.
RADIO-WAVE PROPAGATION MEASUREMENTS OVER SEA WATER
M. M. Algor Aug. 1972 100 p ref
(AD-755511; HDL-TR-1610) Avail: NTIS CSCL 17/2

Propagation loss was measured at three frequencies (30, 140, and 412 MHz) over various sea-water paths out to 40 nautical miles between a moderately elevated shore-based receiving site and a floating transmitter platform essentially at the water's surface and subject to wave motion. The measured losses agreed well with theory, assuming a standard atmosphere for the test conditions. Certain anomalies and ocean-wave effects were noted. In general, meteorological conditions were relatively constant and normal for eastern Florida in summer. Author (GRA)

N73-22092# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
RECURSIVE PLANE ANALYSIS: ITS APPLICATION TO THE STUDY OF PHASE LOCKING IN NONUNIFORM SIGNAL DEPENDENT SAMPLING TECHNIQUES Final Report, Jun. 1970 - Jun. 1972
James C. Rock Jan. 1973 236 p refs
(AF Proj. 7233)
(AD-756918; AMRL-TR-72-34) Avail: NTIS CSCL 09/4

Recursive Plane Analysis (RPA) is presented as a new analysis tool for calculating the complete response of any non-uniform, signal-dependent sampling device with a unit memory to periodic input signals. Pulse Interval Modulation (PIM) and Pulse Frequency Modulation (PFM) devices are used as vehicles for numerous examples presented to demonstrate the application of RPA to engineering problems. The complete response of PIM and PFM modulators to periodic excitation is shown to be the solution to a non-linear finite difference equation. A simple graphical procedure is developed for calculating both the transient and steady state solutions to this equation. Author (GRA)

N73-22093# Naval Postgraduate School, Monterey, Calif.
A QUEUEING MODEL WITH FEEDBACK APPLIED TO A COMMUNICATION PROBLEM WITH INTERFERENCE CAUSED RETRANSMISSIONS M.S. Thesis
Jorg Wilhelm Luneburg Sep. 1972 69 p refs
(AD-756568) Avail: NTIS CSCL 17/2

A queueing model with feedback is proposed as a mathematical representation of a communication system with interference-caused retransmissions. A satellite receives messages of constant length from ground stations. New messages arrive in a Poisson pattern with constant rate. A finite number of channels is available for transmission and channel selection is random among all channels. All messages with overlapping transmission times on the same channel have to be retransmitted. The arrival rate of messages is a composition of the constant arrival rate of the basic Poisson process and the arrival rate of the feedback from retransmissions. The arrival rate is approximated in discrete time steps. A necessary and sufficient condition for a finite limiting point of the resulting sequence of arrival rates is derived. Numerical results for finite limiting points, rate of convergence, and expected number of transmissions have been computed. Examples for sequences of arrival rates have been tabulated. Author (GRA)

N73-22094# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
RECEIVER NOISE DUE TO R/V PLASMA SHEATH TURBULENCE Physical Science Research Papers
Ronald L. Fante 18 Dec. 1972 15 p refs
(AF Proj. 5635)
(AD-756829; AFCRL-72-0735; AFCRL-PSRP-520) Avail: NTIS CSCL 20/14

The report calculates the noise scattered into a receiving antenna system by the turbulent plasma surrounding a reentry vehicle. Sample calculations indicate that turbulent noise should be considered in the systems design of any on-board radar system. Author (GRA)

N73-22095# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS IN PROCESSING OF RADAR SIGNALS
V. K. Sloka 10 Nov. 1972 291 p refs Transl. into ENGLISH of the publ. "Voprosy Obrabotki Radiolokatsionnykh Signalov" Moscow, Sov. Radio, 1970 p 1-256
(AD-756599; FTD-MT-24-920-71) Avail: NTIS CSCL 17/9

Contents: Radar signals and the method of their processing; Output signals of filter devices; Detection of signals against a background of interference and other signals; Signal parameter measurements; Signal processor design principles; Methods for the technical realization of signal-processing devices; Analog electronic filters; Digital electronic filters; Optical filters. GRA

N73-22096# Army Foreign Science and Technology Center, Charlottesville, Va.
INTERFERENCE REJECTION BY BROAD BAND COMMUNICATION SYSTEMS IN THE PRESENCE OF CONCENTRATED INTERFERENCE
A. I. Falko 29 Dec. 1972 13 p refs Transl. into ENGLISH from Tr. Ucheb. Inst. Suyaz: (USSR), 1967 p 16-26
(AD-756590; FSTC-HT-23-1311-72) Avail: NTIS CSCL 17/2

Potential interference rejection of broad-band communication systems in conditions of joint concentrated interference interaction was determined. Possibilities of building a receiver able to provide interference rejection close to potential was examined. Author (GRA)

N73-22097# Pacific Missile Range, Point Mugu, Calif.
ALTITUDE-AIDED RADAR TRACKING
L. L. Goertzen 20 Oct. 1972 33 p refs
(AD-756655; PMR-TP-72-10) Avail: NTIS CSCL 17/9

The report describes an algorithm that is used to determine the maximum likelihood position of an aircraft from the measurement of one radar's range, azimuth, and elevation and from an altitude measurement of the aircraft. The variances of these measurements must also be known. The report also shows how much the altitude-aided algorithm improves the accuracy as compared to a one-radar determination. It was concluded that: The position error in the low radar elevation angle ACMTS (Air Combat Maneuvering Test System) geometry at the Pacific Missile Range, obtained by using a telemetered altitude measurement and the R, A, and E from one radar in the algorithm described in the report, could be reduced from 1/2 to 1/5 that of the position error obtained when only the R, A, E measurement from one radar is used. The altitude measurement greatly reduces the error in determination of the position point when the aircraft being tracked is a large distance from the radar. Author (GRA)

N73-22098# Naval Electronics Lab. Center, San Diego, Calif.
COMPUTER TECHNIQUES FOR FITTING ELECTRON DENSITY PROFILES TO OBLIQUE-PATH VLF PROPAGATION DATA Research and Development Report, Jan. 1970 - Oct. 1972
D. G. Morfitt 16 Jan. 1973 41 p refs
(DNA Proj. NWER-HB-042-05)
(AD-757341; NELC-TR-1854) Avail: NTIS CSCL 20/14

A procedure which makes use of digital computer computational efficiency and versatility was developed to obtain best-fit electron density profiles which describe VLF propagation data. The procedure determines profiles which in some instances describe measured field strength levels very well. In cases in which the best-fit profile error proved to be large, it is probable that smaller errors would be found for computations based on profile shapes not included. As field strength levels are computed as a function of frequency for various other trial profiles, they may be added to the results obtained to date. A completed data bank of this form should be of significant use in determining the electron density profiles characteristic of the ionosphere for propagation measurements made during various seasons over

the Hawaii-Southern California path. The same procedure can also be used to interpret VLF propagation data obtained over other horizontally homogeneous propagation paths.
Author (GRA)

N73-22099# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Electrical Engineering/Electrophysics.
RESEARCH DIRECTED TOWARDS THEORETICAL STUDY OF INTERACTION OF ELECTROMAGNETIC FIELDS Final Report, 1 Jan. 1968 - 30 Sep. 1972
Leopold B. Felsen 1 Nov. 1972 31 p refs
(Contract F19628-68-C-0072; AF Proj. 5635)
(AD-756484; PIBEP-72-120; AFCRL-72-0672) Avail: NTIS CSCL 20/14

The stated work program encompassed the following main phases: Electromagnetic transients in plasmas; Electromagnetic waves in turbulent plasmas; Ray techniques for radiation and diffraction of electromagnetic waves in plasmas and other media.
GRA

N73-22100# Hughes Aircraft Co., Culver City, Calif.
FAULT-TOLERANT DIGITAL AIRBORNE DATA SYSTEM Final Report, Jan. 1971 - Mar. 1972
John D. Anderson, Dale G. Birmingham, and Ronald W. Landgraff Wright-Patterson AFB, Ohio AFFDL Aug. 1972 91 p
(Contract F33615-71-C-1142; AF Proj. 8222)
(AD-756485; HAC-P72-71; AFFDL-TR-72-69) Avail: NTIS CSCL 17/2

An exploratory development project is described that has resulted in the successful design and demonstration of a fault tolerant data transmission and multiplexing system called the Fault Tolerant Digital Airborne Data System (F-DADS). The F-DADS is a modification of the previously demonstrated Digital Airborne Data System (DADS) incorporating redundancy, fault detection, and reconfiguration to achieve fail-operate performance. A replacement system design approach was selected in which one or more spare terminals are activated to replace faulty units to achieve the level of fault tolerance desired. Data handling and fault tolerant performance of the F-DADS was demonstrated by the design, fabrication and test of a three-terminal brassboard demonstration system.
Author (GRA)

N73-22101# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
AN ATMOSPHERIC NOISE MODEL APPLICATION TO LOW FREQUENCY NAVIGATION SYSTEMS Ph.D. Thesis
Donald Alexander Feldman 30 Jun. 1972 207 p refs
(Contract DOT-CG-13446-A)
(AD-757275) Avail: NTIS CSCL 04/1

A prerequisite of the design of low frequency radio receivers is a model for low frequency atmospheric radio noise that encompasse the non-Gaussian nature of the actual noise process and is sufficiently tractable to enable performance analysis and optimization of receiver designs. This work describes a new model for atmospheric noise waveforms observed at the output of the antenna bandlimiting filter. This model, which is based on statistical analysis of sample records of these waveforms, is used to analyze the performance of typical radio navigation receivers and to determine near optimum receiver performance. The analysis is verified by simulating the receiver structure and testing the receiver with the actual noise sample records.
Author (GRA)

N73-22102# Naval Ship Research and Development Center, Bethesda, Md.
LOW COST, HIGH ACCURACY INSTRUMENTATION TAPE RECORDER Final Report
Robert G. Stilwell Dec. 1972 123 p
(AD-757011; NSRDC-3875) Avail: NTIS CSCL 14/3

The report describes a new magnetic tape recording system for general instrumentation use. The system uses a new type of modulation format and offers good performance at low cost. The system concepts are explored from a subsystem or block diagram viewpoint, and extensions of these concepts are hypothesized. An actual prototype is described, its specifications and performance parameters are given, and the results of its evaluation program are presented. The history of the system from 1967 to 1971 is included for completeness. The differential pulse width modulation (DPWM) concept is considered to represent a significant advance in modulation techniques.
Author (GRA)

N73-22103# Naval Postgraduate School, Monterey, Calif.
DESIGN OF A SYSTEM TO MEASURE RADAR CROSS SECTION M.S. Thesis
James David Tadlock Dec. 1972 64 p refs
(AD-756538) Avail: NTIS CSCL 17/9

The instrumentation of a Nike-Ajax radar to perform real-time radar cross section measurements of airborne targets is discussed. Measurements include those based on both radar automatic gain control voltage and radar video pulse peak voltage. Instrumented signals within the radar are conditioned and sent via transmission lines to a CI5000/SDS-9300 hybrid computer. Computed radar cross section and associated analysis information are returned to a display console in the vicinity of the radar.
Author (GRA)

N73-22104# Mitre Corp., Bedford, Mass.
ON OBTAINING CONSTANT FALSE ALARM PROBABILITY IN HF ATMOSPHERIC NOISE
M. R. Weiss Dec. 1972 64 p refs
(Contract F19628-71-C-0002; MITRE Proj. 4140)
(AD-756842; MITR-2414; ESD-TR-72-329) Avail: NTIS CSCL 17/9

The problem of obtaining constant false alarm probability in the presence of atmospheric noise is considered. By comparison with measured data an atmospheric noise model is defined. It is shown that this particular model is suited to a relatively simple Constant False Alarm Rate(CFAR) technique. This CFAR technique uses an adaptive threshold related to the maximum likelihood estimate of the unknown noise power.
Author (GRA)

N73-22105# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A MAXIMUM-LIKELIHOOD MULTIPLE-HYPOTHESIS TESTING ALGORITHM, WITH AN APPLICATION TO MONOPULSE DATA EDITING
E. J. Kelly 9 Feb. 1973 30 p refs
(Contracts F19628-73-C-0002; DOT-FA72WAI-261; FAA Proj. 034-241-012)
(AD-756844; TN-1973-7; ESD-TR-73-66) Avail: NTIS CSCL 09/4

A simple algorithm for multiple-hypothesis testing, based on a generalization of likelihood ratio testing between pairs of hypotheses, is developed and applied to a specific problem. The problem arises in connection with an amplitude comparison monopulse system in an air traffic control application. In particular, it is desired to measure target azimuth in a beacon system in the presence of interference and multipath. The multiple hypotheses relate to the presence or absence of a desired signal, with or without either of two kinds of interfering signal. The analysis leads to a new technique of data editing, or processing, to detect the presence of interference.
Author (GRA)

N73-22106# Washington Univ., Seattle.
STIMULATED AMPLIFICATION OF VLF AND ULF WAVES IN THE MAGNETOSPHERE BY LOCALIZED INJECTIONS OF PLASMA CLOUDS AND PARTICLE BEAMS Final Report
Harold B. Liemohn and G. K. Parks Dec. 1972 134 p refs
Prepared in cooperation with Battelle Mem. Inst., Richland, Wash.
(Contract N00014-67-A-0103-0027; ARPA Order 1479; ARPA Order 2141; NR Proj. 012-712)
(AD-757085) Avail: NTIS CSCL 04/1

The cyclotron resonance interaction between ULF-VLF waves and trapped particles may be strongly enhanced in the magnetosphere by the injection of either cold plasma or energetic particle beams. A variety of natural conditions and injections are investigated numerically using the linear theory. Both satellite and rocket injection of cold plasma provide significant enhancements of amplification. Conventional hot electron beams may also amplify narrow frequency bands, if the beam geometry can be effectively altered at injection. Heavy ion beams appear to offer attractive propagation conditions as well as stimulate amplification.
Author (GRA)

N73-22107# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
APPLICATIONS OF ELECTROMAGNETIC TECHNOLOGY IN

TELECOMMUNICATIONS
C. J. Sletten 12 Jan. 1973 22 p ref Presented at NSF Workshop, Williamsburg, Va., 10 Dec. 1972
(AF Proj. 5635)
(AD-756482; AFCRL-TR-73-0043) Avail: NTIS CSCL 17/2

Based on a presentation at the Workshop on Electromagnetic Theory of Continuous Media sponsored by the National Science Foundation, the paper identifies many science-addressable problems in the areas of radar, air traffic control and communication technologies. Approaches and solutions to these problems are outlined advocating a search for new ideas and concepts strongly focussed on the world of applications. Some discussion of management of research to attain objectives is included.
Author (GRA)

N73-22108# Radio Corp. of America, Camden, N.J. Communications Systems Div.
SENSITIVE THICK FILM IF AMPLIFIER AND DISCRIMINATOR Final Report
F. A. Liebold and C. T. Shelton Feb. 1973 68 p
(Contract DAAB07-71-C-0369)
(AD-756428; ECOM-0369-F) Avail: NTIS CSCL 17/2

The report describes the development of a sensitive IF amplifier and discriminator FM manpack radio sets operating in the 30 to 80 MHz range. The IF amplifier consists of a low loss preselect filter followed by a low noise FET amplifier that drives the first bandwidth definition filter. This filter is followed by two more amplifier stages driving one of three plug-in bandwidth definition filters that are chosen for the desired mode of operation. A third thick film hybrid module consisting of two amplifiers, a limiter stage, a discriminator and an audio amplifier completes the IF amplifier system. Author (GRA)

N73-22109# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MODULATION OF RADAR CROSS SECTION RESULTING FROM PERIODIC MOTION
P. R. Wu 11 Jan. 1973 51 p refs
(Contract F19628-73-C-0002; AF Proj. 1228)
(AD-756488; TN-1973-2; ESD-TR-73-54) Avail: NTIS CSCL 17/9

The radar cross sections amplitude and phase modulations result in a discrete power spectrum when the scattering object undergoes some periodic or repetitive motions. The interpretation of the spectral edge loses its accuracy, as one might expect, from the power spectra of moving but nonperiodic nor repetitive objects. Although the point scatterers are used in motions with higher degrees of freedom, it is sufficient to point out that for any real object, the power spectrum can be quite complex and perhaps unique if the periodic motion is stable relative to the radar line-of-sight over a long observation time. The implication is that one might be able to characterize a spinning object through long observation of its power spectrum; but the lack of an accurate interpretation of the spectral edge precludes any identification effort without a priori information of the geometry of the object. GRA

N73-22110# Naval Undersea Center, San Diego, Calif.
CERTAIN DIGITAL QUADRATURE SIGNAL PROCESSING TECHNIQUES FOR BAND LIMITED SIGNALS Research and Development, Jun. 1971 - Jun. 1972
O. D. Grace Nov. 1972 25 p refs
(NUC Proj. R3651)
(AD-755473; NUC-TP-332) Avail: NTIS CSCL 17/1

The report discusses practical methods for signal processing bandpass signals by digital quadrature methods. These methods assume a sufficiently dense uniform sampling of a bandpass signal and include (1) extractions of quadrature samplings from uniform samplings, (2) polynomial interpolations in which the sampling frequencies f sub s = pi W ensure exact interpolation, and (3) error corrections for interpolations over a finite data base. Also included are applications to the problems of measuring the instantaneous envelope, phase, and frequency of bandpass signals. Author (GRA)

N73-22111# Army Electronics Command, Fort Monmouth, N.J.
CROSS AND SQUARE COMMAND SYMBOL AND VIDEO INSET GENERATOR FOR TELEVISION DISPLAY
C. J. Capriglione and E. A. Karcher Dec. 1972 27 p
(DA Proj. 1F1-62202-A-A97)
(AD-755160; ECOM-4055) Avail: NTIS CSCL 17/2

The report describes the design of a cross and square command symbol generator for display on a television screen. These command symbols are used in aircraft displays to present flight command data to the pilot. The design of a video inset generator is also described which enables a portion of two different video sources to be seen simultaneously on one television screen. The hardware is for use in both the Tactical Avionics System Simulator (TASS) and in the experimental RAVE (Research Aircraft Visual Environment) helicopter. Author (GRA)

N73-22112# Signatron, Inc., Lexington, Mass.
DIGITAL MODULATION ENHANCEMENT STUDY Final Report
Herbert Gish Jan. 1973 96 p refs
(Contract F30602-71-C-0178)
(AD-755939; SIG-A-121; RADC-TR-72-344) Avail: NTIS CSCL 09/4

A new method of nonlinear modulation of analog information is described which gives a substantial improvement in performance over conventional modulation techniques, such as PCM. The modulation technique which the author has called Multistream Modulation (MSMO) provides the capability of designing modulation performance characteristics which can be tailored to specific needs. The theoretical concepts presented were verified by measurements made on a digital transceiver breadboard constructed during this program. The transceiver breadboard included both the MSM and PCM systems. This enables voice experiments to be conducted with the transceiver which provided instantaneous switching from PCM to MSM. The informal voice tests which were carried out showed that the predicted and measured threshold extension over PCM was also obtained with voice communication. Author (GRA)

N73-22113# Avco Corp., Cincinnati, Ohio. Electronics Div.
RADIO SET AN/PRC-70 ( ) Quarterly Report, 1 Jul. - 1 Oct. 1972
C. A. Bucher Nov. 1972 20 p
(Contract DAAB07-71-C-0319; DA Proj. 1S6-67401-D-535)
(AD-755547; Rept-80045-PRC37/1172; ECOM-0319-5; QR-5) Avail: NTIS CSCL 17/2

The fifth quarterly report covers the development work-to-date on the AN/PRC-70 HF/VHF Radio Set for manpack usage. Primary effort during this time interval concerned the completion of individual module testing. Necessary preparation for the testing of subsystem parameters in the Receiver/Exciter and PA/Coupler areas was completed. Author (GRA)

N73-22114# Environmental Technical Applications Center (Air Force), Washington, D.C.
RANDOM ERROR VARIANCE AND COVARIANCE ESTIMATES FROM SIMULTANEOUS RADAR (FPS-16) MEASUREMENTS
Donald R. Johnson and Gray Thompson Sep. 1972 18 p refs
(AD-755402; USAFETAC-TN-72-7) Avail: NTIS CSCL 17/9

The technique of differences or replication is modified to be able to estimate the pure random error variance and covariance components from simultaneous measurements by either radar (FPS-16) or direction finding (AN/GMD-1A) observing systems. An example of the estimation of the random error variance from simultaneous FPS-16 observations is presented. The technique is applicable to the determination of the uncertainty of derived estimates from the basic data, such as geographical position, wind, wind shear, Richardson number, etc.
Author (GRA)

N73-22115# CNR, Inc., Newton Upper Falls, Mass.
LINE-OF-SIGHT WIDEBAND PROPAGATION Interim Technical Report, 31 Jul. - 12 Nov. 1972
Phillip A. Bello, Joseph K. Derosa, and Charles J. Boardman Jan. 1973 186 p refs
(Contract F30602-73-C-0013)
(AD-755922; RADC-TR-73-7) Avail: NTIS CSCL 20/14

The report documents work carried out in three interrelated technical areas: study of channel measurement techniques, modeling the multipath structure of line-of-sight tropospheric

paths, and prediction of spread spectrum modem performance as a function of multipath conditions. As a result of the study it was found that a pseudo-random prober and a multiplexed correlator provide the most cost-effective means of gathering the desired channel parameter information. Modeling of the multipath structure of RCV links was concentrated on the phenomena of atmospheric layers having steep refractive index gradients. Multipath structures were found having from 2 to 4 paths with path delays varying from less than a nanosecond to tens of nanoseconds, with the two-path structure being most common. Error performance curves were obtained for a representative pseudo-noise carrier data modem for a fixed amplitude, random-phase, two-path structure as a function of relative path strength and path delay. Author (GRA)

N73-22116# Network Analysis Corp., Glen Cove, N.Y.
SURVIVABILITY ANALYSIS OF COMMAND AND CONTROL SYSTEMS Final Report, 1 May - 1 Nov. 1972
Howard Frank and Ivan T. Frisch Dec. 1972 129 p refs
(Contract F44620-72-C-0080; AF Proj. 9749)
(AD-755846; AFOSR-73-0195TR) Avail: NTIS CSCL 17/2

The Air Force Office of Scientific Research contracted with Network Analysis Corporation during the period 1 May 1972 to 1 November 1972 to conduct research on the survivability analysis of realistic command and control systems. The report summarizes the findings of the research project. During the first half of the project, effort was aimed at formulating meaningful survivability models and criteria, determining fundamental physical factors affecting survivability analysis and determining suitable approaches to the survivability problem. The second half of the study was aimed at the design and implementation of the probabilistic survivability analysis algorithm and at providing a practical demonstration of its use for a representative network problem. A description of the computer program developed and an example of its application are included in the report. Author (GRA)

N73-22117# Naval Undersea Center, San Diego, Calif.
APPLICATIONS OF THE FINITE-ELEMENT METHOD AND COMPUTER GRAPHICS. A VIBRATIONAL ANALYSIS OF A SONAR PROJECTOR TRANSDUCER ELEMENT Research and Development Report, Jan. 1971 - Jun. 1972
J. T. Hunt, R. R. Smith, D. Barach, L. McCleary, and C. Johnson Dec. 1972 32 p refs
(SF11121304)
(AD-755177; NUC-TP-321) Avail: NTIS CSCL 17/1

The report analyzes the vibratory characteristics of a sonar transducer element using a finite-element three-dimensional mathematical model. The physical meaning of the three constant-voltage-drive eigenvectors predicted by this model is clarified, and the predicted eigenvectors are compared with those measured experimentally. Author (GRA)

N73-22118# Naval Training Equipment Center, Orlando, Fla.
RADAR LANDMASS SIMULATION COMPUTER PROGRAMMING Interim Technical Report, May 1971 - Jun. 1972
Craig K. Brown and Alexander J. Grant Jan. 1973 39 p refs
(AD-755722; NAVTRAEQUIPC-IH-212) Avail: NTIS CSCL 17/9

Several methods have been devised for processing a digital radar data base to create simulated mapping-radar scope images. To aid in the evaluation of these various methods, NAVTRAEQUIPCEN has developed a system which operates in conjunction with its TRADEC System to produce a pseudo real-time radar display. Simulation methods can be simulated on this system for comparison and evaluation. The objective of this report is to describe the software, developed in-house, which processes raw digital radar data to produce a baseline simulation against which other methods may be compared. The software is functionally broken down into three tasks: terrain data processing, cultural data processing, and radar effects. It is written in a high-level language, FORTRAN, to facilitate experimentation and modification. Author (GRA)

N73-22119*# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Jul. 1971 - 30 Jun. 1972
Sven R. Hartmann and William Happer 30 Jun. 1972 113 p refs
(Grant NGR-33-008-012; Contract DAAB07-69-C-0383; Grants DA-31-124-ARO(D)-341; AF-AFOSR-1454-68; AF-AFOSR-2180-72; NSF GP-1424; NSF GP-31336-X; DA Proj. DA 200-61102-B-31F)
(NASA-CR-131829; PR-22; AD-748097; CU-6-72-C-0383) Avail: NTIS HC $7.75 CSCL 07/4

Contents: Atomic hyperfine structure; Atomic lifetimes; Atomic frequency standards; Microwave spectroscopy; Molecular beam maser spectroscopy; Optical radio-frequency double-resonance studies of molecular excited states; Interaction between a neutral beam and a conducting surface; Adiabatic demagnetization in the rotating frame; Photon-echo resonance in neodymium; Photon-echo resonance in ruby; Echo behavior in ruby; Raman echoes; Coherence effects in two-photon absorption; Frequency shifts in resonant systems; Superradiance and pulse propagation; Quantized rotation of superfluid helium; Velocity-dependent occupation of the helium II superfluid state. GRA

N73-22120# Atlantic Research Corp., Alexandria, Va. Jansky and Bailey Engineering Dept.
TROPICAL PROPAGATION RESEARCH, VOLUME 4 Final Report
John J. Hicks, Richard G. Robertson, Charles B. Sykes, and Per A. Antil Dec. 1972 130 p refs
(Contract DA-36-039-SC-90889; ARPA Order 371)
(AD-755257; TR-PL-10126-00-0-Vol-4) Avail: NTIS CSCL 17/2

The report presents results from a special series of measurements designed to characterize the influence of a jungle environment on the transmission of digital signals. Measurements were conducted by transmitting a swept frequency signal, 4 MHz wide about the center frequencies of 50, 100 and 150 MHz, and photographically recording the received envelope and phase, compared to a fixed reference antenna at the receiving terminal. The test antenna was incrementally moved along both a radial and transverse direction with respect to the line of transmission from the transmitter. Author (GRA)

N73-22121# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND FABRICATION OF A SIMPLIFIED BISTATIC RADAR PROCESSOR M.S. Thesis
Charles Edward Carroll Dec. 1972 152 p refs
(AD-756515) Avail: NTIS CSCL 17/9

The bistatic radar processor receives video signals from the bistatic receiver and processes them to obtain the information required to synchronize the PPI display's rotation in rate and phase to the rotation of the transmitting antenna and to correct the range errors. This thesis discusses the design and fabrication of a simplified version of the processor and how it accomplishes the functions mentioned above. Author (GRA)

N73-22122# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME CHARACTERISTICS OF A NOISE-RESISTANT RECEIVER FOR A WIRELESS ELECTRICAL COMMUNICATION CIRCUIT FOR DRILL SPEED MEASUREMENT
G. I. Rzaeva, Yu. S. Kengerlinskii, and V. N. Kulsehov 19 Jan. 1973 15 p refs Transl. into ENGLISH from Za Tekhn. Progress, Sov. Nar. Khoz. Gorkovsk. Ekon. Admin. Raiona (Gorki), no. 5, 1970 p 1-3
(AD-756090; FTD-HT-23-1692-72) Avail: NTIS CSCL 09/6

The paper gives a report on a theoretical study of an optimum receiver designed for isolating a signal from noises in the case of transmission over a wireless communications channel with erasure. Use of optimum phase AFC synthesized on the criterion of minimum mean square measurement error makes it possible to improve interference killing for reception of a signal which contains information on the rotational speed of a turbodrill. GRA

N73-22123# Texas Univ., Austin. Applied Research Labs.
AN ELECTRICAL LOAD FOR SIMULATING A TRANSDUCER IN AN ARRAY
James J. Truchard and William C. Nowlin 17 Dec. 1972 21 p
(Contract N00024-71-C-1213; SF11121303)

(AD-755174; ARL-TM-72-38) Avail: NTIS CSCL 17/1

Individual transducer elements of large sonar arrays are subject to electrical impedance changes as a result of acoustical interactions between neighboring driven elements. In order to transmit acoustic power, the elements are driven individually or in groups by power amplifiers. When a prototype amplifier is constructed, an entire array of transducers and amplifiers may not be available for testing the amplifier. A passive electrical dummy load was constructed to have impedance characteristics equivalent to the particular type of transducer which a prototype current-source switching amplifier was to drive. An active port was added to the electrical dummy load to change the amplifier's load impedance at all frequencies of interest, thereby simulating different positions in a transducer array in which more than one element is driven. The dummy load design technique is described. Author (GRA)

N73-22124# Army Electronics Command, Fort Monmouth, N.J.
INVESTIGATION OF CO2 LASER COMMUNICATIONS FOR ARMY TACTICAL APPLICATIONS
Jack E. Zavin and Larry U. Dworkin Aug. 1972 36 p refs
(DA Proj. 1S0-61101-A-91A)
(AD-756866; ECOM-4014) Avail: NTIS CSCL 17/2

The report gives the preliminary results of two in-house tasks involving the study of the use of CO2 laser communications systems for army tactical applications. The objective is to investigate the feasibility of unconventional approach for CO2 laser communications systems for army tactical applications, in order to overcome present system limitations in the areas of modulation, detection, and detector cooling. The final objective is to develop a design for a small, light weight, wide bandwidth, tactical CO2 laser communications system. The three frequency heterodyne detection system approach is described, a proposed experimental program and tests are discussed, and a comparison with conventional techniques is given. In addition, the report contains a summary of component state-of-the-art and atmospheric propagation effects on 10.6 micrometer laser radiation. Author (GRA)

N73-22125# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
WIDEBAND COMMAND AND CONTROL MODEM WAVEFORM AND MODEM CONCEPTUAL DESIGN STUDY Final Technical Report, 16 Jun. - 16 Dec. 1972
James A. Kivett, Gene F. Bowers, Tonis Tilk, and Willard E. White Dec. 1972 221 p
(Contract F30602-72-C-0500; ARPA Order 2154)
(AD-756933; FR-73-14-158; RADC-TR-73-12) Avail: NTIS CSCL 17/7

The report describes in precise terms the results of the study phase of the Wideband Command and Control Modem (WCCM) program. The study phase was devoted to the performance analysis and conceptual design of a waveform and modem which will provide a jamming-resistant command and control data link for unmanned, remote, multiple, and airborne vehicle control and position location. Direct sequence, 60 Mpps keying rate, spread-spectrum signalling using binary continuous phase shift modulation is recommended for both forward and return link communication between the ground control station (GCS) and the remotely controlled vehicles (RCVs). The forward link employs a single channel, time division multiplexed, continuous transmission for communication of command messages to the RCVs. A multichannel hybrid FDMA/TDMA return link waveform design is recommended for minimum complexity of the RCV modem and maximum flexibility in configuring the ground station for a wide range of operational requirements. (GRA)

N73-22126# Harvard Univ., Cambridge, Mass. Cruft Lab.
RESEARCH STUDIES ON ELECTROMAGNETIC RADIATION AND ANTENNAS: A SUMMARIZING REVIEW Final Report, 1 Nov. 1967 - 31 Oct. 1972
Ronald W. P. King Nov. 1972 27 p refs
(Contract F19628-68-C-0030; AF Proj. 5635)
(AD-756915; AFCRL-72-0728) Avail: NTIS CSCL 09/5

Research studies on electromagnetic radiation and antennas are summarized for the period beginning November 1, 1967 and ending October 31, 1972. Brief reviews are given of work on antenna arrays, electrically thick antennas, modified dipole antennas, the end correction for monopole antennas, antennas in different media, and scattering from finite cylinders and imperfectly conducting spheres. Author (GRA)

N73-22315* National Aeronautics and Space Administration, Washington, D.C.
IONOSPHERIC DISTURBANCES
R. A. Zevakina *In its* Ionosphere Disturbances and their Influence on Radio Commun. Apr. 1973 p 1-33 refs (For availability see N73-22314 13-13)
CSCL 17B

N73-22326* National Aeronautics and Space Administration, Washington, D.C.
CALCULATION OF RADIOWAVE ABSORPTION AND FIELD INTENSITY FOR OBLIQUE INCIDENCE ON THE IONOSPHERE BASED ON VERTICAL SOUNDING DATA
Yu. R. Pushkin and M. D. Fligel *In its* Ionosphere Disturbances and their Influence on Radio Commun. Apr. 1973 p 231-249 refs (For availability see N73-22314 13-13)
CSCL 20N

N73-22327* National Aeronautics and Space Administration, Washington, D.C.
THE INFLUENCE OF IONOSPHERIC AND MAGNETIC DISTURBANCES ON SHORT-WAVE RADIO COMMUNICATIONS
R. A. Zevakina, M. V. Kiseleva, G. N. Pushkova, and V. A. Chernova *In its* Ionosphere Disturbances and their Influence on Radio Commun. Apr. 1973 p 250-260 refs (For availability see N73-22314 13-13)
CSCL 17B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-22127 University of Southern Calif., Los Angeles.
SPEECH GENERATION AND RECOGNITION UNDER HYBRID COMPUTER CONTROL Ph.D. Thesis
Rene Marcel Doublier 1972 239 p
Avail: Univ. Microfilms Order No. 72-26009

This research was concerned with the design, development and testing of the hardware/software systems necessary to produce synthetic speech, using a set of linguistic rules as its only input data. Evaluation of the quality of the artifically-produced speech is made not only from a spectral analysis standpoint, but also through carefully constructed and administered intelligibility tests. The set of linguistic rules developed as a basis for the generation of artificial speech can be adapted to the initial phases of research into machine recognition of human speech, and several fundamental considerations towards the eventual solution of this problem are presented. Dissert. Abstr.

N73-22128 Case Western Reserve Univ., Cleveland, Ohio.
A DIAGNOSTIC COMPUTER SYSTEM FOR FAULT DIAGNOSIS OF DIGITAL CIRCUITS Ph.D. Thesis
Fredric Rowland Boswell 1972 244 p
Avail: Univ. Microfilms Order No. 72-26138

A programmable, computer controlled test automation system for performing fault diagnostic tests on digital circuits and subsystems is described. The system employs a serial, stored response organization to apply preset or adaptive test sequences to the unit under test. Test sequences are encoded in a problem oriented, English-like language. An interactive software operating system facilitates test sequence preparation and fault isolation. A digital test processor subsystem incorporates hardware for automatic detection of terminal faults and certain classes of intermittent faults. The system architecture emphasizes modularity at both the hardware and software level to accommodate additional digital test capacity and extension to hybrid and linear circuit testing. Dissert. Abstr.

N73-22129*# Texas A&M Univ., College Station. Engineering Experiment Station.
AUTOMATIC SYSTEM FOR COMPUTER PROGRAM DOCUMENTATION Final Report
Dick B. Simmons, Roger W. Elliott, Susan Arseven, and Daniel Colunga Dec. 1972 424 p refs
(Contract NAS5-11911)
(NASA-CR-130231) Avail: NTIS HC $23.25 CSCL 09B

Work done on a project to design an automatic system for computer program documentation aids was made to determine what existing programs could be used effectively to document computer programs. Results of the study are included in the form of an extensive bibliography and working papers on appropriate operating systems, text editors, program editors, data structures, standards, decision tables, flowchart systems, and proprietary documentation aids. The preliminary design for an automated documentation system is also included. An actual program has been documented in detail to demonstrate the types of output that can be produced by the proposed system. Author

N73-22130*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH IN ADVANCED FORMAL THEOREM-PROVING TECHNIQUES Final Report, 18 Jun. 1970 - 1 Jun. 1971
J. F. Rulifson Jun. 1971 11 p refs
(Contract NASw-2086; SRI Proj. 8721)
(NASA-CR-131591) Avail: NTIS HC $3.00 CSCL 09B

The present status is summarized of a continuing research program aimed at the design and implementation of a language for expressing problem-solving procedures in several areas of artificial intelligence, including program synthesis, robot planning, and theorem proving. Notations, concepts, and procedures common to the representation and solution of many of these problems were abstracted and incorporated as features into the language. The areas of research covered are described, and abstracts of six papers that contain extensive description and technical detail of the work are presented. Author

N73-22131# Lockheed Missiles and Space Co., Palo Alto, Calif.
CORRELATIONS, CHAPTER 2
V. I. Vinokurov and R. A. Vakker [1972] 24 p Transl. into ENGLISH from the book "Voprosy Obrabotki Slozhnykh Signalov v Korreliatsionnyk Sistemakh" Sovetskoe Radio, Moscow, 1972 p 35-64
Avail: NTIS HC $3.25; National Translations Center, John Crerar Library, Chicago Ill. 60616

Basic principles involved in the construction of correlators are discussed in terms of direct and indirect methods which assure continuous multiplication of the processes under investigation by simple methods and with requisite accuracy. The correlation function is considered for each of the random processes. In addition, characteristics of an ideal difference-frequency are discussed along with error analysis and signal to noise ratios.
J.M.M.

N73-22132# Hamburg Univ. (West Germany). Fachbereichs Mathematik.
BAYES DYNAMIC DECISION AND STOP MODELS Ph.D. Thesis [BAYESSOHE DYNAMISCHE ENTSCHEIDUNGS-UND STOPPMODELLE]
Ulrich Rieder 1972 141 p refs In GERMAN
Avail: NTIS HC $9.25

The application of Bayes dynamics for optimal decision and stop models containing an unknown factor is described. Model calculations for a decision process that can be stopped at anytime at one point and delivers the terminal gain for that point, are presented. Transl. by G.G.

N73-22133# Planning Research Corp., McLean, Va.
COMPATIBLE MODULES CONCEPTS STUDY Final Technical Report, Nov. 1970 - Jun. 1972
David A. Borgeson Griffiss AFB, N. Y. RADC Sep. 1972 40 p refs
(Contract F30602-71-C-0096; AF Proj. 4594)
(AD-749910; PRC-R-1612; RADC-TR-72-225; Rept-73-00797) Avail: NTIS HC $4.00

The objectives, concepts, and results of the compatible module concepts study are presented. Concepts for designing compatible, modular data management systems (DMS) and the development of a structural framework for interfacing modules and tailoring these systems to specific environments, while ensuring overall compatibility within the data handling community, are addressed. A conceptual generalized DMS, facilitating all envisioned requirements for DMSs in the 1970s, is presented and serves as a vehicle for functionally partitioning modules and developing this structural framework which emphasizes a design from the top-down approach for future systems. A preliminary operational/functional specification for the resultant conceptual DMS structural architecture is defined in some detail, by identifying the functional components (modules) allocated to each functional area of the DMS and by identifying the major interfacing parameters and defining the communications/interrelationships between functional areas. Author

N73-22134# United Aircraft Corp., Windsor Locks, Conn.
RASTER PLOTTER SOFTWARE. VOLUME 2: SOFTWARE DOCUMENTATION
Rodney T. Boorse, David L. Sharp, and Gerald L. Sperber Griffiss AFB, N. Y. RADC Jan. 1972 338 p
(Contract F30602-71-C-0107)
(AD-740606; HSER-5924; RADC-TR-72-2-Vol-2) Avail: NTIS HC $19.00

A color coding scheme for hierarchically representing the cartographic symbology associated with JOG series 1501-A charts was developed and implemented. The scheme employs a three level hierarchy, with up to ten colors available for each level. The first level of color coding is accomplished on a registered, transparent overlay to the base manuscript. The annotative procedure is straightforward and permits rapid color tagging with very low error raster. Based on this color coding scheme, computer programs which accomplish the necessary recognition and interpretation of these color codes were developed and demonstrated. Color tagged raster data comprised the input to these programs, while the output comprised lineal data fully annotated in accordance with the prescribed code structure. In this process, separate scannings are required for the base manuscript and the coded overlay. Author

N73-22135*# Computer Sciences Corp., Huntsville, Ala.
DIGITAL PROCESSING OF RADIOGRAPHIC IMAGES Contractor Report, Oct. 1971 - Oct. 1972
A. D. Bond and H. K. Ramapriyan Washington NASA Apr. 1973 208 p refs
(Contract NAS8-21805)
(NASA-CR-2213; M541) Avail: NTIS HC $3.00 CSCL 09B

Some techniques are presented and the software documentation for the digital enhancement of radiographs. Both image handling and image processing operations are considered. The image handling operations dealt with are: (1) conversion of format of data from packed to unpacked and vice versa; (2) automatic extraction of image data arrays; (3) transposition and 90 deg rotations of large data arrays; (4) translation of data arrays for registration; and (5) reduction of the dimensions of data arrays by integral factors. Both the frequency and the spatial domain approaches are presented for the design and implementation of the image processing operation. It is shown that spatial domain recursive implementation of filters is much faster than nonrecursive implementations using fast fourier transforms (FFT) for the cases of interest in this work. The recursive implementation of a class of matched filters for enhancing image signal to noise ratio is described. Test patterns are used to illustrate the filtering operations. The application of the techniques to radiographic images of metallic structures is demonstrated through several examples. Author

N73-22136# Planning Research Corp., McLean, Va.
DATA MANAGEMENT SYSTEM TEST METHODOLOGY DEVELOPMENT Final Report, Apr. 1971 - Apr. 1972
William W. Ferguson Griffiss AFB, N. Y. RADC Jul. 1972 278 p refs
(Contract F30602-71-C-0252)
(AD-748811; R-1604; RADC-TR-72-171) Avail: NTIS HC $16.00 CSCL 09/2

A methodology to be employed in the testing of data management is proposed and some recommendations for the continued development of a DMS Test Methodology are submitted. The intent is to first characterize a data management system by

identifying the various attributes that should comprise a DMS and summarize the techniques that can be employed in implementing these capabilities. Secondly, the standard test techniques that can be used to measure the capabilities of the aforementioned attributes were examined. To assist in methodology utilization, a correlation between particular attributes and specific measurement techniques was drawn and scenarios were written to illustrate how the methodology would be employed in the solution of some typical DMS measurement problems. Finally, it was concluded that analysis, benchmark programs, and software monitors were the most useful test techniques available and warrant additional development. Author

N73-22137# Societe Crouzet, Valence (France). Div. Aerospatial.
FEASIBILITY STUDY OF AN ON-BOARD WIRE MEMORY. VOLUME 1: TEXT Final Report [ETUDE DE FAISABILITE D'UNE MEMOIRE A FILS EMBARQUABLE. VOLUME 1: TEXTE]
[1972] 89 p In FRENCH 3 Vol.
(Contract ESTEC-1523/71-HP)
(Rept-26/1422/EC/MB/Vol-1; ESRO-CR(P)-221) Avail: NTIS HC $6.50

A feasibility study is presented of a plated wire memory and its associated electronic circuits and components for use as a central storage unit in satellite-borne computers. The following topics are discussed: configuration of the storage unit, memory organization, general functioning, electronic circuits, technological realization, and reliability. The most important results concern a volume and weight reduction of 50 per cent for the 8 K storage block; 18 base bits seem to be attainable without losing the modular structure compatible with the envisaged applications. ESRO

N73-22138# Societe Crouzet, Valence (France). Div. Aerospatial.
FEASIBILITY STUDY OF AN ON-BOARD WIRE MEMORY. VOLUME 2: DIAGRAMS Final Report [ETUDE DE FAISABILITE D'UNE MEMOIRE A FILS EMBARQUABLE. VOLUME 2: FIGURES]
[1972] 65 p In FRENCH
(Contract ESTEC-1523/71-HP)
(Rept-26/1422/EC/MB/Vol-2; ESRO-CR(P)-222) Avail: NTIS HC $5.25

A feasibility study is presented of a plated wire memory and its associated electronic circuits and components for use as a central storage unit in satellite-borne computers. The following topics are discussed: (1) configuration of the storage unit, (2) memory organization, (3) general functioning, (4) electronic circuits, (5) technological realization, and (6) reliability. The most important results concern a volume and weight reduction of 50 per cent for the 8 K storage block; 18 base bits seem to be attainable without losing the modular structure compatible with the envisaged applications. ESRO

N73-22139# Plessey Co., Ltd., Towcester (England).
FEASIBILITY STUDY OF AN ON-BOARD WIRE MEMORY. VOLUME 3: DEVELOPMENT OF NDRW PLATED WIRE FOR SPACE APPLICATIONS Final Report, Apr. - Sep. 1972
G. Chillingsworth and K. Papworth 1972 132 p Prepared for Soc. Crouzet Sponsored by ESRO
(ME-72/6; ESRO-CR(P)-223-Vol-3) Avail: NTIS HC $8.75

The development of nickel-iron plated wires with a nondestructive read/write (NDRW) characteristic for computer memories is discussed. The deposition technology is described and the manufacturing to test specifications is discussed. Using constraints relating to memory cross point and method of drive, ways to improve the NDRW plated wire are described. Accelerated aging trials, carried out to gain confidence in the reliability of the product for the minimum life time limits, are also described. ESRO

N73-22140# Singer Co., Glendale, Calif. Librascope Div.
DATA ENTRY AND EDIT MONITOR Quarterly Progress Report, 1 Jul. - 30 Sep. 1972
T. Shelton Dec. 1972 44 p
(Contract DAAB07-72-C-0277; DA Proj. 1S6-63703-D-654)
(AD-756934; ECOM-0277-1; QPR-1) Avail: NTIS CSCL 09/2

The Data Entry and Edit Monitor, is a rear ported CRT display including a projector for overlay projection onto the CRT screen, and associated electronics to interface with an external data source. Physically, the device is packaged as a display unit, a power supply unit, and associated cables. During the reporting period, the concentration of effort was primarily on basic system configuration in order to provide the functional design data. Author (GRA)

N73-22141# University of South Florida, Tampa.
SCEPTRE TRANSLATOR FEASIBILITY STUDY Final Technical Report
James C. Bowers, John E. OReilly, Jr., Gary A. Shaw, and Richard D. Tabbutt 23 Jan. 1973 86 p refs
(Contract DAAA21-72-C-0760)
(AD-755166) Avail: NTIS CSCL 09/2

The basic objectives of the research are to investigate the feasibility of and determine the best input format for a SCEPTRE translator capable of providing a point-to-point input of one-dimensional mechanical systems to the SCEPTRE compiler. The objectives have been realized by studying the SCEPTRE program. The compiler accepts point-to-point (or node-to-node) input of electrical elements of resistance, capacitance, inductance, voltage sources, and current sources. The ability of SCEPTRE to formulate differential equations from a topological description of an electrical circuit and to solve these equations with such programming ease on the user's part, prompted the search for electrical analogs with point-to-point mechanical systems for direct input through a SCEPTRE translator. The search was directed toward one-dimensional systems since electrical circuits processed by SCEPTRE are actually only one-dimensional current flow networks (i.e. current can flow in only one-dimension, thus current is a scalar quantity). With this approach in mind, the mathematical formulation of an acceptable mechanical to electrical (here-in denoted mechano-electrical) analog is established. Author (GRA)

N73-22142# Morgan (Howard L.) Associates, Merion Station, Pa.
A STUDY OF INTERRUPT HANDLING FACILITIES FOR THE AADC Final Report
Howard Lee Morgan 31 Oct. 1972 35 p refs
(Contract N00953-73-M-0051)
(AD-756665; N72002) Avail: NTIS CSCL 09/2

A study was made of the interrupt handling facilities in the proposed AADC system and associated master executive control (MEC) and programming languages. The type of interrupt generating conditions, both hardware and software, which are relevant and useful to AADC are discussed. Language constructs for interrupt processing in high level languages are made. Then, the need for synchronizing primitives such as the Dijkstra semaphores is shown. A discussion of scheduling methods for processes is presented. Author (GRA)

N73-22143# Naval Postgraduate School, Monterey, Calif.
AN ANALOG COMPUTER FOR USE WITH X-ARRAY HOT WIRE ANEMOMETERS
Gustave Hokenson Jan. 1973 22 p
(AD-756532; NPS-57HW73011A) Avail: NTIS CSCL 14/2

The design of an analog computer is presented which accurately reduces the output signals of an X-array hot wire anemometer into their basic components and calculates their auto- and cross-correlations in both time averaged and instantaneous form. A prototype model is shown with certain unique features such as simultaneously available multiple outputs which give it a distinct superiority over commercially available units. Author (GRA)

N73-22144# Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.
MEDIUM SPEED MASS RANDOM ACCESS MEMORY MODULE Final Report
Robert A. White and Glenn M. Krueger Griffiss AFB, N. Y. RADC Jan. 1973 34 p
(Contract F30602-69-C-0325)
(AD-755937; PX-5407-50; RADC-TR-72-331) Avail: NTIS CSCL 09/2

The objective of the program is to develop a preproduction model of a solid-state, plated-wire memory module to operate in an airborne or tactical field environment with a command

and control system computer. This module was designed within the basic constraints that the completed 10 million bit module is both random access in its retrieval mode and reliable in a tactical field application while the cost per bit of the module in production remained sufficiently low ($0.01 to $0.015 per bit), to be acceptable to the users. The module was designed, fabricated, and tested to the requirements of MIL-E-5400 over an operating range of 0C to 55C. Basically, the final environmental test results bore out the design criteria in that the module was successfully tested for shock, vibration, humidity, etc., without any evidence of significant design problems. The module is presently at Rome Air Development Center where it is scheduled for use in various Air Force applications. Author (GRA)

N73-22145# Maryland Univ., College Park. Computer Science Center.
DIGITAL PICTURE PROCESSING: PROPERTIES
Azriel Rosenfeld Jan. 1973 37 p refs
(Contract N00014-67-A-0239-0062)
(AD-755701) Avail: NTIS CSCL 09/2

The report contains the near-final version of Chapter 11 of a forthcoming book on digital picture processing. It covers picture properties: transformation-invariant properties and normalization; important special types of properties (local and textural; linear -- using subpictures or mathematical functions as templates); and property complexity. Author (GRA)

N73-22146# Maryland Univ., College Park. Computer Science Center.
PICTURE PROCESSING, 1972
Azriel Rosenfeld Jan. 1973 78 p refs
(Contract N00014-67-A-0239-0012)
(AD-755702; TR-217) Avail: NTIS CSCL 09/2

Developments in the field of picture processing by computer during 1972 are surveyed, and a bibliography is given that covers much of the literature published during that period, as well as a few items inadvertently omitted from previous surveys. The topics covered include picture compression; image enhancement; matched filtering, edge and curve detection; picture processing implementations; pictorial pattern recognition; picture properties; picture parts and picture description; and picture automata and grammars. Author (GRA)

N73-22147# Maryland Univ., College Park. Computer Science Center.
DIGITAL PICTURE PROCESSING: STRUCTURE
Azriel Rosenfeld Nov. 1972 99 p
(Contract N00014-67-A-0239-0062)
(AD-755699) Avail: NTIS CSCL 09/2

The report contains the near-final version of Chapter 10 of a forthcoming book on digital picture processing. It covers picture segmentation (thresholding, tracking) and the geometrical analysis of picture segments (topology, size and shape, relationships). Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-22148 Rice Univ., Houston, Tex.
SWITCHING PHENOMENA IN LITHIUM DRIFTED SILICON PIN DIODES Ph.D. Thesis
Thomas Lamson Harman 1972 262 p
Avail: Univ. Microfilms Order No. 72-26416

The low injection reverse recovery switching phenomena in lithium-drifted PIN diodes were studied both experimentally and by computer analysis. The experimental investigations were made on a PIN device at selected stages of the fabrication process. Also, numerical analysis of a realistic mathematical model was undertaken to ascertain the effects of a varying intrinsic region width on the diode properties. The change in carrier lifetime during the fabrication process was computed using the Shockley-Read combination model. Dissert. Abstr.

N73-22149 Southern Methodist Univ., Dallas, Tex.
PHASE OPTIMIZATION AND SYNTHESIS OF ANTENNA ARRAYS Ph.D. Thesis
Robert Clifton Voges 1972 140 p
Avail: Univ. Microfilms Order No. 72-27305

A theoretical treatment of the analysis, optimization and synthesis of arbitrary array antennas using variable phase and constrained amplitude excitation is presented. This optimization problem is nonlinear so that linear techniques are not applicable; the steepest ascent method is a useful technique for nonlinear problem solution and is employed. The gradient for an arbitrary performance index expressible as a ratio of Hermitian quadratic forms is derived, and phase optimization is demonstrated for the directive gain case using both linear and circular arrays. The classic Hansen-Woodyard condition which exhibits the possible improvement in gain for endfire arrays using phase is compared with the optimum phase condition for an endfire linear array. The far-field radiation pattern synthesis of an array antenna is demonstrated using a point matching technique for sidelobe control, and a least-mean-square-error match is used to synthesize a pulse pattern. Dissert. Abstr.

N73-22150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BANDED TRANSFORMER CORES AND A METHOD AND DEVICE FOR PROVIDING THE SAME Patent Application
William T. McLyman, inventor (to NASA) Filed 28 Aug. 1972 29 p Sponsored by NASA
(NASA-Case-NPO-11966; NASA-Case-NPO-13159; US-Patent-Appl-SN-284245) Avail: NTIS HC $3.50 CSCL 09E

A banded transformer core is described which positions a pair of mated, similar core halves on a supporting pedestal, with a strap encircling the core halves, and selectively applying tension. A compressive force is thus applied about the periphery of the core for reducing the innate air gap between the core halves, and welding the strap at a cruciform joint. A dc magnetic field is employed in supporting the core halves during initial phases of the banding operation, while an ac magnetic field subsequently is employed for detecting dimension changes occurring in the air gaps as tension is applied to the strap. NASA

N73-22151*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEANS FOR ACCOMMODATING LARGE OVERSTRAIN IN LEAD WIRES Patent Application
Carl V. Rumble and Kendall L. Driscoll, inventors (to NASA) Filed 25 Apr. 1973 10 p
(NASA-Case-LAR-10168-1; US-Patent-Appl-SN-354407) Avail: NTIS HC $3.00 CSCL 09A

An electrical wire along whose length loops are formed at intervals is described that is retained in a plastic capsule and can unfold when tension is exerted on the opposite ends of the wire. The capsule is formed by encompassing each loop with a sleeve of heat shrinkable synthetic plastic material which overlaps the loop. Thus, a length of electrical wire is formed which stores extra lengths in the quantity needed to match the expected stretching of materials or elements such as ropes, cords and the like of high elongation to which the electrical wire may be attached. NASA

N73-22152*# Cambridge Thermionic Corp., Mass.
DEVELOPMENT OF A dc MOTOR WITH VIRTUALLY ZERO POWERED MAGNETIC BEARING
Apr. 1971 78 p
(Contract NAS5-21587)
(NASA-CR-130225) Avail: NTIS HC $6.00 CSCL 09E

The development of magnetic bearings for use in direct current electric motors is discussed. The characteristics of the magnets used in the construction of the bearings are described. A magnetic bearing using steel armoring on permanent magnets was selected for performance tests. The specifications of the motor are presented. The test equipment used in the evaluation is described. Author

N73-22153*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
STUDY OF THE COLLECTOR/HEAT PIPE COOLED EXTERNALLY CONFIGURED THERMIONIC DIODE Final Report
6 Mar. 1973 83 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953074)
(NASA-CR-131602; WANL-PR-953074-14) Avail: NTIS HC $6.25 CSCL 09A

A description is given of the design approach followed and the results of the analysis leading up to the reference thermionic module designs, both initial and revised. Engineering layout drawing for components of both modules are given. Various steps taken in the component fabrication and the module assembly are detailed. Author

N73-22154# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
MATERIALS FOR MAGNETIC HEADS (DISK STORAGE UNITS) Final Report [MATERIAUX POUR TETES MAGNETIQUES (MEMOIRES A DISQUE) RAPPORT FINAL]
A. Lagrange [1971] 51 p refs In FRENCH
(Contract DRME-69-34-680-00-480-75-01)
(Rept-9.451) Avail: NTIS HC $4.75

Application of the pressure synthesis to Ni-Zn ferrimagnetic spinels is discussed. These spinels are intended for use as magnetic write and read pick-ups for disks. The influence of chemical and technological parameters on the properties of the pressure synthetized Ni-Zn ferrites are analyzed. The influence of chemical composition including that of stoichiometry on factors important to the purpose of the ferrites are discussed. ESRO

N73-22155# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
MOS PHOTODETECTORS Final Report [PHOTODETECTEURS A STRUCTURE MOS COMPTE RENDU FINAL]
B. DeCremoux and A. Benoit 8 Jul. 1971 67 p In FRENCH
(Contract DRME-69/34.354)
Avail: NTIS HC $5.50

The possibility of realizing MOS photodetector mosaics for application to the readout of optical memories with charge storage by irradiation is investigated. From prior work done in the field it was concluded that doping with gold is necessary for operation without charge storage. It was found that the gold doping creates a manufacturing problem, and a decision was made to develop MOS devices with a charge storage collector instead. ESRO

N73-22156# Defence Research Information Centre, Orpington (England).
REDUCTION OF THE NON-UNIFORMITY OF THE DISPLACEMENT OF THE ELECTRON BEAM ON THE VIDICON SCREEN AT THE EDGES OF THE RASTER
A. V. Petrakov Jan. 1973 6 p refs Transl. into ENGLISH from Tekh. Kino i Televideniya (Moscow), v. 6, 1972 p 60-61
(DRIC-Trans-2966; BR-30330) Avail: NTIS HC $3.00

A method for reduction of the nonuniform nature of the displacement of the electron beam on a vidicon screen at the edges of a raster is described. This method, a double scanning of the raster to the limits of the frame considered, used with the help of automatic television devices using vidicon directly connected to an electronic digital computer, is effective when reference points are distributed at the edges of the raster and particularly so for a low-definition scanning standard. ESRO

N73-22157# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
THE CARMIN SYSTEM [CARMIN RAPPORT D'ETUDE]
C. Thinet, C. Lemonon, P. Oprandi, and Y. Renard 19 Nov. 1971 65 p In FRENCH
(Contract DTAT-SEFT-509/179/50)
(LCR-DR-1-71-210/1/R) Avail: NTIS HC $5.25

Electronic equipment used in a model of the CARMIN system IR television camera for terrain analysis in the 8-13 micrometer band is described. The system has the following properties: image velocity, 16 images per second; spatial resolution, elementary field of 0.5 milliradian; thermal resolution, 0.5 to 25 C. The field of view is from 5 deg 48 min to 3 deg 26 mins. The electronic parts for visualization associated with the optics and the cryogenics of the infrared detector mosaic, and their operation are detailed. The parts include: (1) the linear mosaic of 120 mercury doped germanium detectors with the MOS for impedance adaptation; (2) the elementary amplifiers necessary for stepping up the signal level before switching; (3) the 120 channel MOS switching device for sampling; and (4) the switching sequence generator. ESRO

N73-22158# Fulmer Research Inst., Ltd., Stoke Poges (England).
DESIGN OF HIGH TEMPERATURE INTEGRATED CIRCUIT HOLDERS
B. A. Hatt and D. Stewart 23 Nov. 1972 21 p
(Contract ESTEC-1496/71-AA)
(BAH/DS/AG/R-412/1; ESRO-CR(P)-198) Avail: NTIS HC $3.25

A device holder for testing electronic components such as flat-packs, transistors, and axial lead devices, at high temperatures was designed. Prototypes were made and tests showed the holders to be satisfactory for operation at 200 C for 500 hours and at 350 C for 48 hours. Author (ESRO)

N73-22159# Application et de Societe Technique d Recherche Electronique, Massy (France).
MULTIPLE BEAM ANTENNA FOR AN AIR TRAFFIC CONTROL SATELLITE. OPTIMIZATION OF PRINCIPAL PARAMETERS AND DEVELOPMENT OF A TEST MODEL [ANTENNE A FAISCEAUX MULTIPLES POUR SATELLITE DE CONTROLE DE TRAFIC AERIEN. OPTIMISATION DES PRINCIPAUX PARAMETERS ET REALISATION D'UN MODELE PROBATOIRE]
13 Nov. 1972 89 p refs In FRENCH
(Contract ESTEC-1514/71-CG)
(ESRO-CR(P)-199; Rept-945) Avail: NTIS HC $6.50

The design and optimization of a multiple beam antenna for an air traffic control satellite is presented. The antenna works in the L band and is built up out of a set of sources which illuminate a reflector, every source associated with a transmitter and a receiver. The principal source and its integration with the other sources is studied. The choice of the primary source and the focal distance of the mirror diameter is discussed. An antenna model was constructed and tested. ESRO

N73-22160# Defence Research Information Centre, Orpington (England).
INCREASE IN RESOLUTION POWER OF CAMERA TUBES
Y. A. Ryftin and V. M. Myasnikov Jan. 1972 17 p refs Transl. into ENGLISH from Tekhn. Kino i Telev. (Moscow), v. 8, Aug. 1972 p 37-42
(DRIC-Trans-3025; BR-30389) Avail: NTIS HC $3.00

The possibility of changing the form and size of the aperture diaphragm of the electron gun is discussed in order to increase the resolving power of camera tubes without increasing the size of the tubes. The distribution of electron density in the switching beam is considered and it is shown that the best increase is obtained with a large square aperture. ESRO

N73-22161# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
DESIGN, FABRICATION AND EVALUATION OF AN ELECTRON BEAM ADDRESSABLE HIGH INFORMATION DENSITY MEMORY TUBE Quarterly Progress Report, 1 Sep. - 30 Nov. 1972
Charles Q. Lemmond Feb. 1973 32 p
(Contract DAAB07-72-C-0098; DA Proj. 1H6-31024-D-252)
(AD-756936; SRD-73-026; ECOM-0098-3; QR-10) Avail: NTIS CSCL 09/2

The technical objective of this development program is the design, fabrication, and evaluation of an experimental model electron beam addressable, high information density memory tube. The tube is to be a sealed-off, selfcontained unit consisting of an electron source, the necessary electron optics for performing the required write and read functions, and a storage structure containing approximately 10 million elements. During this quarter the first fly's-eye lens-experimental tube structure was assembled and tested. This tube (ETS-2) was assembled with a phosphor screen in place of the target, and tests of the beam control elements were made. The tube performed to our expectations. Tube ETS-3 was assembled. Fly's-eye lenses were assembled

and tested to determine their dimensional stability when subjected to a vacuum bake. GRA

N73-22162# GTE Sylvania, Inc., Mountain View, Calif. Electro-Optics Organization.
INFRARED PHOTOCATHODE RESEARCH Final Report, 1 Nov. 1969 - 31 Dec. 1972
H. Sonnenberg 31 Dec. 1972 42 p refs
(Contract N00014-70-C-0079; ARPA Order 1806)
(AD-756239) Avail: NTIS CSCL 09/1

The report summarizes the results of three years of research on infrared photocathodes. Among the highlights covered by the report are the following: discovery of the most efficient 1.06 micron photocathode, development of optimum photocathode processing procedures, quantum yield at 1.3 microns approaching that of the S-1 photosurface at 1.06 microns, empirical relations between the optimum thickness of Cs2O low-work-function surface and the wavelength, empirical relations between the yield and thickness and between the escape probability and thickness of Cs2O-activated photosurfaces, heterocathode concept, a new approach to potentially-efficient infrared photoemission, and low-temperature growth of GaAs on Ge by the Gallium-diethyl-chloride technique. Author (GRA)

N73-22163# Naval Postgraduate School, Monterey, Calif.
THE PERIODIC DIRECTIONAL FILTER M.S. Thesis
Kenti Tsukada Sep. 1972 42 p refs
(AD-756567) Avail: NTIS CSCL 09/1

The report presents computational methods for the analysis of periodically coupled transmission lines. Two methods are described for obtaining the scattering matrix of two cascaded four-port networks where the S-matrix of the individual networks are known. One method uses the scattering transfer matrix and the other method gives the elements of the scattering matrix directly in terms of the elements of the matrices of the individual networks. GRA

N73-22164# Army Electronics Command, Fort Monmouth, N.J.
SPECTRAL DIGITAL FREQUENCY SYNTHESIZER
Dieter R. Lohrmann and Kyung S. Son Oct. 1972 53 p refs
(DA Proj. 1S6-62701-A-350)
(AD-756864; ECOM-4034) Avail: NTIS CSCL 09/5

The report outlines improvements of the Spectral Synthesizer described in Technical Report ECOM-3265 (AD-707425) dated April 1970. The lockup time was reduced and the precision voltage divider networks in the oscillator tuning circuit were eliminated. Author (GRA)

N73-22165# Naval Missile Center, Point Mugu, Calif. Electronic Warfare Div.
EXPERIMENTAL INVESTIGATION INTO A COMMUTATIVE FILTER
Marvin L. Ryken, Jr. 6 Mar. 1973 40 p refs
(AD-756662; NMC-TP-73-723) Avail: NTIS CSCL 09/5

A commutative filter is a bandpass filter capable of very high Q's, large range of resonant frequency (0 to 2 megahertz that can be electronically tuned), comb-filter frequency response, small bandwidth (independent of resonant frequency), and extremely small size (can be constructed of integrated circuits since no inductors are required). The purpose is to present the general theory and evaluation of a commutative filter, in which presentation the effects of leaky capacitors and load resistance are considered. An eight-channel filter is built, and laboratory and theoretical results are compared for the transfer function, bandwidth, quality factor, and sensitivity of the commutative filter. The commutative filter is also investigated from the viewpoint of enhancement of signal-to-noise ratio. Author (GRA)

N73-22166# California Univ., Los Angeles. School of Engineering and Applied Science.
POTENTIAL INDUCED BY A POINT SOURCE OF CURRENT INSIDE AN INFINITE CYLINDRICAL CELL
A. Peskoff, R. S. Eisenberg, and J. D. Cole Jan. 1973 76 p refs
(Contract N00014-69-A-0200-4033)
(AD-756666; UCLA-ENG-7303) Avail: NTIS CSCL 12/1

The potential is determined everywhere inside an infinitely long cylindrical cell, for a point source of current at an arbitrary location in the cell interior. The mathematical techniques used are applicable to a wide variety of physical problems with mixed boundary conditions in cylindrical geometry in which a small parameter appears in the boundary condition. The model for the cell consists of a cylinder of radius a, with an interior of conductivity sigma sub i, surrounded by a thin membrane of conductivity sigma sub m and thickness delta. The cell is bathed in a highly conducting external medium which maintains the outer membrane surface at zero potential. Using the singular perturbation technique of matching, the near-field and far-field expansions are made to coincide in an intermediate overlap region. A relatively simple form is obtained for the far field expansion, consisting of the known result of one-dimensional cable theory plus correction terms. The higher order terms are obtained as eigenfunction expansions, double infinite sums of Bessel function, or alternatively as single infinite sums of infinite integrals of modified Bessel functions. Author (GRA)

N73-22167# Army Electronics Command, Fort Monmouth, N.J.
A WIDEBAND ANTENNA-IMPEDANCE SIMULATOR
W. P. Czerwinski Jan. 1972 22 p refs
(DA Proj. 1J0-61102-B-31-A)
(AD-757141; ECOM-4074) Avail: NTIS CSCL 09/5

A relatively small cylindrical chamber is described which provides the capability to simulate the operational impedance characteristics of a whip antenna throughout the frequency range 30-76 MHz. This chamber, which does not contain tuning elements, is made of an aluminum cylinder with the inner surface lined with a highly absorbing ferrite tile. To adjust the impedance-controlling networks of a wideband whip antenna, the top portion of the antenna whip is replaced by a metal disc and the assembly positioned axially within the chamber. The use of this chamber greatly simplifies tuning and power testing of the impedance controlling networks of wideband whip antennas. Author (GRA)

N73-22168# Army Electronics Command, Fort Monmouth, N.J.
ELECTROMECHANICAL ENERGY CONVERSION DEVICES UTILIZING BOTH CONVENTIONAL AND RARE EARTH COBALT PERMANENT MAGNET MATERIALS
R. L. Ross, O. J. Iafrate, and F. Rothwarf Dec. 1972 28 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-756433; ECOM-4064) Avail: NTIS CSCL 09/1

The recent development of the high coercivity, rare-earth alloys such as cobalt-samarium and cobalt-cerium represents a major advance in the field of applied magnetism. The unique properties of these materials promise to revolutionize the design of devices employing permanent magnets. However, as with all new advances in material science, criteria must be established to effectively incorporate the inherent advantages existent within these new materials. Consequently, certain device configurations are not conducive to the incorporation of the new rare-earth cobalt materials. Such a limitation is illustrated in the first design considered; the flux modulation generator which employs conventional Alnico material. The second design discussed in detail is the moving-coil generator employing Co5Sn or Co5Ce material. Both devices may be used to convert mechanical motion into electrical energy and are applicable to improving the power output of existing fluidic generators used to power artillery and rocket fuzing systems. Theoretical predictions are given and alternator configurations are suggested for improving generator performance. Author (GRA)

N73-22169# Ohio State Univ., Columbus. Electroscience Lab.
ANALYSIS AND DESIGN OF SPECIAL ANTENNA CONFIGURATIONS
G. A. Richard, J. H. Richmond, and N. H. Geary Aberdeen Proving Ground, Md. Ballistic Res. Labs. Nov. 1972 132 p refs
(Contract DAAD05-69-C-0031)
(AD-756470; BRL-CR-81) Avail: NTIS CSCL 09/5

A new reaction solution was formulated for three-dimensional wire antennas located in free space or over a ground plane, using a piecewise-sinusoidal expansion for the unknown current distribution on the antenna. A set of linear equations was developed for solution by a digital computer. Impedance, radiation efficiency, field patterns, gain, and directivity can be calculated. Computer programs based on this new formulation

were used to determine the impedance versus frequency for various loop antennas. Verification of the calculations with experimental results showed that the technique is highly accurate not only for the impedance but also for the current distribution. Calculated and measured results for several three-dimensional dipoles and a square halo antenna are also given. Author (GRA)

N73-22170# Naval Postgraduate School, Monterey, Calif.
A COMPUTER TECHNIQUE FOR NEAR FIELD ANALYSIS OF AN ULTRASONIC TRANSDUCER M.S. Thesis
Carlton Albert Griggs Mar. 1973 61 p refs
(AD-756537) Avail: NTIS CSCL 09/1

A computer technique for obtaining near-field cross-section views of an ultrasonic field is presented. The technique is applied to ultrasonic transducer radiation patterns with sample contour drawings of several cross-sections. A spatial frequency spectrum formulation of diffraction theory is chosen for the computations which are performed with the aid of a fast Fourier transform routine. By experimentation an actual ultrasonic field was generated using a quartz transducer and the field was measured in a cross-sectional plane. A computer generated drawing of the measured data is compared to the drawing of a computer generated prediction of the field at the same plane.
Author (GRA)

N73-22171# Watkins-Johnson Co., Palo Alto, Calif.
RELIABILITY TESTING OF ELECTRON BOMBARDED SEMICONDUCTOR DIODES Final Technical Report
Aris Silzars Jan. 1973 40 p
(Contract N00014-72-C-0329; NR Proj. 243-007)
(AD-755449; W-J-72-4098R1) Avail: NTIS CSCL 09/1

Reliability tests of reverse biased semiconductor diodes under CW electron beam bombardment are described. A semiconductor target, with aluminum top metallization was tested at 6 W/sq mm diode dissipation density for 1037 hours and at 10 W/sq mm for an additional 1045 hours. A second device with two diodes operating Class B has been tested for 1016 hours at 1 W/sq mm dissipation density. These latter diodes had platinel-silicide top metallization and integral beam shields. Diode reverse breakdown voltage drops of less than 5 percent, after an initial stabilization, are reported. Author (GRA)

N73-22172# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
MONOLITHIC LIGHT EMITTING DIODE DISPLAY Quarterly Technical Report, 1 Jun. - 31 Aug. 1972
Lawrence C. Kravitz Dec. 1972 17 p
(Contract DAAB07-72-C-0125; DA Proj. 1S6-62705-A-055)
(AD-755204; SRD-72-125; ECOM-0125-2; QTR-2) Avail: NTIS CSCL 09/5

The objective of this contract is the development of a display system consisting of light emitting diode arrays monolithically fabricated on single wafers of GaP, and integrated with the driving electronics. Progress in the design and development of prototype ceramic substrates strip metallization and green array fabrication are reported. The program for the next quarter is outlined. Author (GRA)

N73-22173# Hamilton Standard, Windsor Locks, Conn.
HIGH-PRESSURE VIBRATING PRESSURE TRANSDUCER Final Report
Elbert M. Moffatt Nov. 1972 50 p
(Contract DAAJ02-71-C-0067; DA Proj. 1F1-62203-A-434)
(AD-755533; USAAMRDL-TR-72-42) Avail: NTIS CSCL 09/1

The report describes the modifications and testing done to develop a high-pressure version of the vibrating cylinder pressure transducer previously developed at Hamilton Standard Division. The previous designs of this device were rated at 20 and 50 psia maximum pressure and -65F to 250F operating temperature. The modification is rated at 250 psia and -65F to 200F. In addition, the results of a company project to develop a modification for higher temperatures (up to 400F) are reported. The vibrating cylinder pressure is an extremely accurate device which is currently being used in the air inlet control of the F-15 aircraft. It is small and light and has no moving parts aside from the vibrating member, so its life is indefinitely long.
Author (GRA)

N73-22174# Radio Corp. of America, Lancaster, Pa. Electronic Components.
A 400 AMPERE HIGH POWER TRANSCALENT SEMICONDUCTOR THYRISTOR DEVICE Final Report, 26 Jan. 1971 - 30 Oct. 1972
S. W. Kessler Oct. 1972 88 p refs
(Contract DAAK02-69-C-0609)
(AD-755553; Rept-5) Avail: NTIS CSCL 09/1

The design of a 400 Ampere High Power Transcalent Thyristor is described in this report. Work performed was devoted to the development of a silicon thyristor wafer which could be cooled from both sides in the transcalent package. The heat pipes that are attached to the silicon thyristor wafer are a simple self-contained thermodynamic system which exhibits an effective thermal conductivity several orders of magnitude greater than copper. Design of the devices is discussed with emphasis on the design and fabrication of the Silicon Thyristor Wafer, metallization techniques, and heat pipe construction.
Author (GRA)

N73-22175# Hughes Research Labs., Malibu, Calif.
ACOUSTIC VELOCITY CORRELATOR DEVELOPMENT Semiannual Technical Report, 1 Mar. - 1 Oct. 1972
Melvin E. Pedinoff, William R. Smith, Jr., and Michael Waldner Dec. 1972 66 p
(Contract DAAB07-72-C-0121; DA Proj. 7X2-63304-D-215)
(AD-755198; ECOM-0121-1) Avail: NTIS CSCL 09/1

The Doppler velocity correlator is a surface acoustic wave device whose ultimate function is to correct the phases of signals obtained from a pulse burst processor type of multiply tapped surface acoustic wave delay line and to sum these phase corrected signals in a single Doppler velocity channel. Because of the need for numerous Doppler output channels, the device can consist of many input and output channels. The purpose of the program reported here is to demonstrate the feasibility of this concept. During the first half of the program, a critical design review was conducted; the survey included a critique of the transducer designs for both input and output channels, the tradeoff involved in using transducer position shift or metallization for the Doppler phase correction, and an analysis of the electrical-mechanical package design. Author (GRA)

N73-22176# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTENNAS
V. V. Nikolskii 15 Dec. 1972 482 p refs Transl. into ENGLISH of the book "Antenny" Moscow, Izd-vo Svyaz, 1966 p 1-368
(AD-755689; FTD-MT-24-1993-71) Avail: NTIS CSCL 09/5

Contents: Electrodynamic fundamentals of antenna theory; Radiator-system directivity and antenna design; Transmission lines; Linear antennas; Surface antennas; Traveling-wave antennas; Functional features of antennas; The radiation field of the generalized Huygens element; Table of mutual impedances.
GRA

N73-22177# Collins Radio Co., Cedar Rapids, Iowa.
TRANSCEIVER MULTICOUPLER Semiannual Progress Report, 15 May - 15 Nov. 1972
Harvey L. Landt Dec. 1972 41 p refs
(Contract DAAB07-72-C-0179)
(AD-755548; ECOM-0179-1; Rept-523-0764553-00111M; SAPR-1) Avail: NTIS CSCL 09/5

The report covers the initial progress on a program to develop an exploratory developmental model of a transceiver multicoupler in the 30- to 80-MHz frequency range. The theoretical development and analysis leading to a satisfactory design for the multicoupler is presented. Experimental laboratory data is presented to support the theoretical development. Schematics and drawings to support the overall design concept are included. Curves and data showing the computed performance of the 10-channel transceiver multicoupler are also presented.
Author (GRA)

N73-22178# Naval Postgraduate School, Monterey, Calif.
A STUDY OF EFFECTS OF HIGH ENERGY ELECTRON RADIATION ON SELECTED ELECTRONIC DEVICES M.S. Thesis
Thomas Francis Lane Jun. 1972 44 p refs

(AD-756215) Avail: NTIS CSCL 09/1

The study investigates the behavior of TTL NAND Gates (Signetics SE480Q) and MOS Field Effect Transistors (2N4067) in an electron radiation environment (produced by the Naval Postgraduate School Linear Accelerator). The electron radiation within two planetary radii of Jupiter is estimated to be of the order of 50 million electrons per square centimeter per second. The Grand Tour outer planets space probe was to spend about ten hours in this environment thus receiving an exposure of about 2 X 10 to the 12th power electrons/sq. cm. Exposures of about 10 to the 15th power electrons/sq. cm. for TTL NAND Gates and 10 to the 14th power electrons/sq. cm. for the MOSFETS were required before failure or serious degradiation of performance occurred. Therefore, in the electron environment near Jupiter, satisfactory operation should be expected for about 500 hours for the MOSFETS and 5000 hours for the TTL NAND Gates.

Author (GRA)

N73-22179# Fairchild Camera and Instrument Corp., Mountain View, Calif. Semiconductor Components Group.

AN INVESTIGATION OF THIN SINGLE-CRYSTAL SILICON FILMS ON INSULATOR/POLYCRYSTALLINE SILICON SUBSTRATES Final Technical Report, 1 Apr. - 31 Dec. 1971

Theodore I. Kamins Feb. 1973 145 p refs

(Contract DAHC15-72-C-0171; ARPA Order 2053)

(AD-756646) Avail: NTIS CSCL 09/1

The report summarizes the results of a nine-month, research-and-development study of the material properties of thin, single-crystal silicon films supported by insulator/polycrystalline-silicon substrates. Considerable effort was devoted to developing reproducible processes for the fabrication of these thin films, and methods were developed to evaluate their quality. After reasonable film quality had been obtained, the properties of the films were investigated in more detail. The majority-carrier mobility and minority-carrier lifetime were studied. Diffusion of dopant impurity atoms into the films and oxidation of the films were considered, and the stress in the thin films was investigated.

GRA

N73-22180# Naval Postgraduate School, Monterey, Calif.

IMPATT DIODE AMPLIFIER M.S. Thesis

Charles Thomas Key Dec. 1972 37 p refs

(AD-756520) Avail: NTIS CSCL 09/5

A high performance IMPATT diode test circuit was developed which is very effective in reducing spurious oscillations of the diode under test by controlling the impedance presented to the diode by the circuit. In this circuit, a 10 GHz silicon diode was tested as an amplifier with power gains in excess of 20 db.

Author (GRA)

N73-22181# Army Electronics Command, Fort Monmouth, N.J.

EXPERIMENTAL ANALYSIS OF NEW ULTRAVIOLET EMITTING FIBER OPTIC FACEPLATE CATHODE RAY TUBES

Joseph Pucilowski, Jr. and Orville R. Harper Nov. 1972 27 p refs

(DA Proj. 1H6-62705-A-055)

(AD-755509; ECOM-4052) Avail: NTIS CSCL 09/1

An experimental analysis of new ultraviolet (UV) emitting, fiber-optic faceplate cathode-ray tubes (CRT) was performed. Detailed studies were carried out for a tube with emission centered near 380 nanometers (nm). Initial data taken on a tube whose emission was centered near 320 nm showed that its radiant output was below expectations, probably due to problems encountered during faceplate manufacture. Consequently, it was not possible to perform a comprehensive analysis on this tube. This study represented the first operational analysis of these CRT, and writing rates on various dry-process, UV sensitive recording media were measured for the 380 nm tube. A comparison has been made with a state-of-the-art 380 nm CRT. Theoretical calculations indicated that the new 380 nm CRT should have at least nine times the energy output of available CRT. Agreement with theoretical calculations was excellent. Results are summarized and performance is discussed.

Author (GRA)

N73-22182# IIT Research Inst., Chicago, Ill.

PROPERTIES OF TAPERED SURFACE WAVE TRANSDUCERS Final Report, 14 May - 14 Dec. 1972

Anthony P. VanDenHeuvel Feb. 1973 79 p refs

(Contract DAAB07-72-C-0197)

(AD-756935; IITRI-E6236; ECOM-0197-F) Avail: NTIS CSCL 09/1

A study program was conducted to investigate and analyze the properties of tapered interdigital transducers as flat bandpass devices. A model of the transducer structure was developed and used to predict performance characteristics. Good agreement with experiment was observed. Two demonstration devices, a delay line and a filter, with approximately 25% flat bandpass response were designed and built using tapered transducers on YZ-lithium niobate. Recommendations for future work are made on the basis of the overall results of the program.

Author (GRA)

N73-22183# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TUNNEL DIODE AND ITS MICROWAVE AMPLIFICATION AND OSCILLATION, PART 1

Shih-Chieh Wang 26 Feb. 1973 28 p refs Transl. into ENGLISH from Tien-Tzu Chi-Shu (Shanghai), no. 2, 1964 p 19-23

(AD-756932; FTD-HC-23-1698-72) Avail: NTIS CSCL 09/1

The tunnel diode is a new type of semiconductor device. Its operating theory is based on the penetration of electrons through the narrow p-n junction barrier by quantum mechanical tunneling. At present, more than 350 kinds of tunnel diodes are listed as commodities among which, those used in the microwave area have a resistive cutoff frequency approaching 30 GHz. The characteristic parameters of tunnel diodes used in the microwave area are shown in order to indicate the present level of tunnel diode development.

GRA

N73-22184# Army Foreign Science and Technology Center, Charlottesville, Va.

PROBLEMS OF RELIABILITY OF SEMICONDUCTOR THERMOELECTRIC DEVICES

V. A. Efimov, B. S. Lupanov, and N. F. Shatalova 27 Dec. 1972 7 p refs Transl. into ENGLISH from Kholod. Tekhn. Tekhnol. (Kiev), no. 3-5, 1970

(AD-756898; FSTC-HT-23-1085-72) Avail: NTIS CSCL 09/1

Various types of thermoelectric devices are considered and their qualitative reliability indices are presented. The area of applicability of the exponential law of the probability density distribution of rejections is described for computations on the devices mentioned. On the basis of an analysis of the quantitative reliability indices, and the design and technological features of the devices, a series of recommendations are given with respect to an increase of the reliability and quality of the devices in question. Rejections are considered which took place during tests and exploitation of the devices, and the most common of them are considered with the object of demonstrating the causes for their occurrence.

Author (GRA)

N73-22185# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.

LOW ANGLE RADIATION OF AN ANTENNA OVER AN IRREGULAR GROUND PLANE Scientific Interim Report

James R. Wait 7 Nov. 1972 15 p refs

(Contract PRO-Y-71-872; AF Proj. 5636)

(AD-756911; AFCRL-72-0661; SR-60) Avail: NTIS CSCL 09/5

Using the Compensation Theorem, first-order expressions are obtained for the radiation fields of a monopole antenna located over an irregular ground surface with finite conductivity. The azimuthally symmetric case is considered and the results are applied to the situation where the monopole is located on an elevated circular plateau with sloping sides. It is indicated that the antenna gain and the ground wave excitation are enhanced over that for a uniformly flat surface.

Author (GRA)

N73-22186# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

GaAs JUNCTION FIELD-EFFECT TRANSISTOR RADIATION STUDY Final Report, 1 Jun. 1971 - 1 Dec. 1972

Rainer Zuleeg and Kurt Lehovec Nov. 1972 101 p refs

Sponsored in part by Defense Nucl. Agency
(Contract F19628-71-C-0218; AF Proj. 6096; AF Proj. 6076)
(AD-756914; MDC-G4368; AFCRL-72-0716) Avail: NTIS CSCL 09/1

The report conducts an experimental investigation of GaAs J-FET's and their electrical parameter degradation in a fast neutron environment, an experimental investigation of GaAs J-FET's and their electrical behavior (transient response) in gamma radiation environment, and an experimental investigation of GaAs J-FET's in digital logic function circuits with respect to the threshold of changing logic state induced by ionizing (gamma) radiation.
GRA

N73-22187# Washington Univ., Seattle. Dept. of Electrical Engineering.
EVAPORATED COPPER CONTACTS TO CADMIUM SULPHIDE
Steven J. McCarthy, Eric Lind, and Sinclair S. Yee Dec. 1972 34 p refs
(Contract F33615-71-C-1275; AF Proj. 7885)
(AD-756876; ARL-72-0172) Avail: NTIS CSCL 09/1

The electric, photoelectric, and electroluminescence properties of Cu contacts evaporated onto CdS have been measured. Diffusion potentials of approximately 1.0 ev were found; the current transport was found to be via tunneling; the backwall spectral response of the short-circuit current was between .55 microns and 1.05 microns; and electroluminescence was observed between .75 microns and 1.0 microns at quantum efficiencies of approximately 10 to the minus 8th power photons per electron. These results are compared to the characteristics of a Cu-CdS Schottky barrier and a Cu2S-CdS heterojunction. This comparison shows that a Cu-CdS Schottky barrier does not always occur when Cu is evaporated onto CdS. Instead, the Cu can react chemically with the CdS to form a Cu2S layer underneath the evaporated copper contact resulting in a Cu2S-CdS heterojunction.
Author (GRA)

N73-22916* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLAT CONDUCTOR CABLE DEVELOPMENT
Ralph Herndon *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 1-11 (For availability see N73-22915 13-34)
CSCL 09A

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-22188*# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
RESEARCH INTO ADVANCED CONCEPTS OF MICROWAVE POWER AMPLIFICATION AND GENERATION UTILIZING LINEAR BEAM DEVICES Final Status Report, Nov. 1966 - Nov. 1972
P. R. McIsaac Dec. 1972 48 p refs
(Grant NGL-33-010-047)
(NASA-CR-130208) Avail: NTIS HC $4.50 CSCL 09C

A theoretical study of some aspects of the interaction between a drifting stream of electrons with transverse cyclotron motions and an electromagnetic field is presented. Particular emphasis was given to the possible generation and amplification of millimeter waves. The major effort was devoted to a theoretical study of the cyclotron resonance oscillator. The appendices include published papers on the cyclotron resonance oscillator which resulted from this investigation.
Author

N73-22189# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A METHOD OF DETERMINING THE CORRELATION FUNCTION OF NORMALIZED RANDOM PROCESSES
V. F. Nesteruk and N. N. Porfireva [1972] 3 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 5, no. 6, 1962 p 55-57
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is presented for obtaining functions of normal random processes with the experimental determination of the sign. A two-threshold system of instantaneous values of the random function at different levels in a correlator circuit is considered where one threshold is in the domain of positive deviation, and the other in the negative domain. It is shown that the circuit is feasible, and reliable in operation.
F.O.S.

N73-22190# Joint Publications Research Service, Arlington, Va.
DISCHARGING OF INDUCTIVE POWER ACCUMULATOR FOR GENERATING SHORT-FRONT PULSE
V. N. Bolshakov 1 May 1973 13 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 1, 1972 p 56-60
(JPRS-58892) Avail: NTIS HC $3.00

The basic parameters of the discharge circuit of an inductive accumulator for generating a current pulse with a short front are discussed.
Author

N73-22191# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
COMPUTER-AIDED OPTIMIZATION OF MICROWAVE CIRCUITS
William Gary Briscoe Jan. 1973 167 p refs
(AD-756875; RE-73-3) Avail: NTIS CSCL 09/5

A new optimization method called the MUltiple PROjected Fibonacci (MUPROF) search is developed and applied to the design of microwave circuits. The MUPROF search is an elimination type direct search method. It is an extension of the projected Fibonacci search devised by Krolak and Cooper and requires about one-tenth the computation time required by the projected Fibonacci search. A wide variety of microwave circuits can be designed by using the MUPROF search to find the optimum values for up to six design variables of a microwave circuit. The complete design optimization program for microwave circuits is formed by combining the optimization program with a general microwave circuit analysis subroutine.
Author (GRA)

N73-22192# Army Electronics Command, Fort Monmouth, N.J.
NOISE QUALITY INVESTIGATION OF VARIOUS MICROWAVE DEVICES
Calvin D. Bates Jan. 1973 35 p refs
(DA Proj. 1S6-62705-A-055)
(AD-756862; ECOM-4070) Avail: NTIS CSCL 14/2

Measurements are described for investigating various microwave devices. A computer program was modified to assess the experimental probability density function (PDF) between various sigma values. Experimental results on four different devices are included and demonstrate the utility of the measurement scheme and the computer results. Gaussian, broadband noise electron beam sources were demonstrated and a solid-state noise source investigated with respect to PDF quality.
Author (GRA)

N73-22193# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
BURST PROCESSOR TAPPED DELAY LINE Interim Report, 1 Oct. 1971 - 1 Nov. 1972
T. W. Bristol, H. M. Gerard, E. H. Ross, and W. R. Smith Jan. 1973 51 p refs
(Contract DAAB07-72-C-0046)
(AD-755194; FR-73-14-70; ECOM-0046-1; IR-1) Avail: NTIS CSCL 09/1

The object of the program is to develop and demonstrate a Doppler resolution filter configured as a tapped delay line. The device will operate at a center frequency of 200 MHz and a 50 MHz 1 db bandwidth. The Burst Processor Tapped Delay Line geometry will use a parallel channel approach such that each delay output is derived from a separate acoustic channel. The device employs double electrodes for both input and tapping (output) transducers; the input consists of a simple, periodic transducer with six double electrodes, while the outputs use novel phase-reversal transducers with eleven electrodes. The BPTDL also uses a 300 MHz reference channel which directly measures the time delay and controls the insertion phase by means of a temperature control system. The delay line design

has been thoroughly analyzed and experimentally tested. The photomask has been designed and ordered. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-22194 Ernst-Mach-Inst., Freiburg (West Germany).
DEVELOPMENT AND TESTING OF A SIMPLE FAST CLOSING VALVE [ENTWICKLUNG UND TEST EINES EINFACHEN SCHNELLSCHLUSSVENTILS]
H. Giesbrecht, A. Stilp, and G. Goetting 1972 17 p In GERMAN; ENGLISH summary
(Rept-5/72) Avail: Issuing Activity

A commercial gas valve was modified into a fast closing valve for wind tunnel application by using two compressed air cylinders and a trigger mechanism. Closing times were measured with a high speed rotating mirror camera. Experiments show that a valve of 125 mm inner diameter can be closed within 2 ms by using a driver pressure of 25 atmospheres. The application of this valve in an aeroballistic tunnel is discussed. ESRO

N73-22195*# Scientific Translation Service, Santa Barbara, Calif.
THE WATER BATH AS A PARTIAL SIMULATOR FOR WEIGHTLESSNESS IN SPACE MEDICINE
Heinz VonDiringshofen Washington NASA Apr. 1973 12 p refs Transl. into ENGLISH from Arch. Physik. Therapie (Leipzig), v. 4, 1962 p 307-311
(Contract NASw-2483)
(NASA-TT-F-14884) Avail: NTIS HC $3.00 CSCL 14B

Experiments using the water bath for simulation of space flights in the laboratory are described. The mechanical effects of the water bath are reported as causing a parasympathetic alteration. Experiments revealed a tendency to orthostatic collapse in long experiments—in direct proportion to duration of immersion. Author

N73-22196# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
GRUMMAN JET NOISE FACILITY
A. Maciulaitis, J. T. Yen, A. L. Lind, and A. L. Loeffler, Jr. May 1973 58 p refs
(RE-450) Avail: NTIS HC $5.00

A jet noise test facility is described. Hot film anemometers have been used with a specially designed traversing mechanism to measure mean and turbulent velocites in the jet flow. The basic acoustic instrumentation consists of microphones mounted at the ends of three 23-foot booms which swing through the nozzle's axis of symmetry. These microphones provide information on the directionality and strength of the far field noise emanating from the jet. Flow and acoustic measurements made to date are in good agreement with data of other investigators. One of the major unsolved problems of jet noise research is the determination of the distribution of noise sources within the jet flow. Author

N73-22197*# Avco Corp., Wilmington, Mass. Government Products Group.
DEMONSTRATION OF THE USE OF ADAPT TO DERIVE PREDICTIVE MAINTENANCE ALGORITHMS FOR THE KSC CENTRAL HEAT PLANT Final Report
Herbert E. Hunter Nov. 1972 211 p refs
(Contract NAS10-7926)
(NASA-CR-131571; AVSD-0084-73-RR) Avail: NTIS HC $12.75 CSCL 20M

The Avco Data Analysis and Prediction Techniques (ADAPT) were employed to determine laws capable of detecting failures in a heat plant up to three days in advance of the occurrence of the failure. The projected performance of algorithms yielded a detection probability of 90% with false alarm rates of the order of 1 per year for a sample rate of 1 per day with each detection, followed by 3 hourly samplings. This performance was verified on 173 independent test cases. The program also demonstrated diagnostic algorithms and the ability to predict the time of failure to approximately plus or minus 8 hours up to three days in advance of the failure. The ADAPT programs produce simple algorithms which have a unique possibility of a relatively low cost updating procedure. The algorithms were implemented on general purpose computers at Kennedy Space Flight Center and tested against current data. Author

N73-22198# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEST BENCH FOR HIGH-ALTITUDE BY-PASS ENGINE
K. K. Bokov 25 Feb. 1972 7 p Transl. into ENGLISH from the Russian Patent no. 249002 (Appl. no. 1226842/24-6, 20 Mar. 1968), 1969 p 1-2
(AD-742376; FTD-HT-23-1375-71) Avail: NTIS HC $3.00 CSCL 14/2

This invention pertains to the area of bench testing of ducted fan engines under conditions close to those of flight. Test benches for high altitude turbojet engines, including by-pass engines, consist of exhaust diffuser and pressure chamber with engine being tested, a turbo-cooling unit for suppling air to the engine under pressure and temperature corresponding to conditions of flight, and an exhaust unit with a cooler, connected to the pressure chamber exhaust diffuser with a line for removing and cooling exhaust gases. In testing by-pass engines with high by-pass ratio it is necessary to supply the engine with a large volume of air than when testing a single pass engine or by-pass engine with decreased by-pass level. Great technical difficulties are encountered in cooling and drying large volumes of air supplied to the bench and during the removal of the exhaust gases while ensuring the rarefaction corresponding to the simulated altitude of flight. Author

N73-22199# Howard, Needles, Tammen and Bergendoff, Alexandria, Va.
AIRPORTS AND URBAN DEVELOPMENT: SOME PLANNING ISSUES
F. Roy Madgwick [1973] 17 p refs Presented at 55th Ann. Conf. of Am. Inst. of Planners, Boston, 10 Oct. 1972
Avail: NTIS HC $3.00

The effects of airport operations on urban development were studied. The subjects discussed were: (1) the economic impact of airports, (2) distribution of airport related activities, (3) commercial activities produced by major airport operations, (4) residential development, and (5) prediction of future effects on ecomomy and ecology. Author

N73-22200# British European Airways, London (England). Corporate Planning Dept.
THE COST OF AIRPORT CONGESTION
J. Richard Graham 1972 31 p refs Presented at the ITA Symp., 29 Nov. 1972
(Rept-73-00315) Avail: NTIS HC $3.75

An account is made of conditions which foster civil airport congestion and flight delays which result in lost resources, wasted time, and inconvenience to paying air passengers. An air industry economic analysis is used to demonstrate the unfeasibility of new airports to cope with the conditions owing to adverse social and environmental factors. It rather is interpreted to conclude that the most viable method of dealing with congestion and delay must involve investment, on the part of the airlines, in larger aircraft to provide improved efficiency using already existing facilities. J.M.M.

N73-22201*# National Aeronautical Establishment, Ottawa (Ontario).
SURVEY OF NEEDS AND CAPABILITIES FOR WIND TUNNEL TESTING OF DYNAMIC STABILITY OF AIRCRAFT AT HIGH ANGLES OF ATTACK
K. J. Orlik-Rueckemann 1973 128 p refs
(Contract NAS2-7279)
(NASA-CR-114583) Avail: NTIS HC $8.50 CSCL 14B

A survey was conducted relative to future requirements for dynamic stability information for such aerospace vehicles as the

space shuttle and advanced high performance military aircraft. High-angle-of-attack and high-Reynolds number conditions were emphasized. A review was made of the wind-tunnel capabilities in North America for measuring dynamic stability derivatives, revealing an almost total lack of capabilities that could satisfy these requirements. Recommendations are made regarding equipment that should be constructed to remedy this situation. A description is given of some of the more advanced existing capabilities, which can be used to at least partly satisfy immediate demands. Author

N73-22202# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TWO DIMENSIONAL AEROFOIL TEST FACILITY IN THE S3 BLOW-DOWN WIND TUNNEL OF MODANE-AVRIEUX
Maurice Bazin 1972 17 p refs In FRENCH; ENGLISH summary
(ONERA-NT-203) Avail: NTIS HC $3.00

A device for two-dimensional airfoil testing in the transonic test section of the intermittent blow-down wind tunnel S3 of Modane was designed and built. Aerofoils up to 0.3m chord length can be studied by pressure surveys up to Mach 0.95, with stagnation pressure ranging from 1.2 to 4.0 bars. The Reynolds number can thus be varied in a broad range, reaching 15.10 to the 6th power at Mach 0.95. The main features of the device are outlined and its various components are described. They include test section with horizontal perforated walls, 0.78 m X 0.56 m rotating supports for angle of attack changes from -35 to +215 degrees, mobile rake for wake pressure survey, models with wall pressure taps. The method and means for data acquisition are given, along with the aerodynamic features of the test device and the visualization methods used. Author

N73-22203*# Singer Co., Binghamton, N.Y. Simulation Products Div.
SHUTTLE MISSION SIMULATOR REQUIREMENTS REPORT, VOLUME 1, REVISION A
J. F. Burke 23 Mar. 1973 423 p refs
(Contract NAS9-12836)
(NASA-CR-128890) Avail: NTIS HC $23.25 CSCL 14B

The tasks are defined required to design, develop, produce, and field-support a shuttle mission simulator for training crew members and ground support personnel. The requirements for program management, control, systems engineering, design and development are discussed along with the design and construction standards, software design, control and display, communication and tracking, and systems integration. F.O.S.

N73-22204*# Singer Co., Binghamton, N.Y. Simulation Products Div.
SHUTTLE MISSION SIMULATOR REQUIREMENT REPORT, VOLUME 2, REVISION A
J. F. Burke 23 Mar. 1973 166 p refs
(Contract NAS9-12836)
(NASA-CR-128886) Avail: NTIS HC $10.50 CSCL 14B

The training requirements of all mission phases for crews and ground support personnel are presented. The specifications are given for the design and development of the simulator, data processing systems, engine control, software, and systems integration. F.O.S.

N73-22205# Federal Aviation Administration, Washington, D.C.
DEVELOPMENTS IN AIRPORT PAVING CRITERIA
Philip L. Melville [1972] 38 p refs
Avail: NTIS HC $4.00

The Federal Aviation Administration (F.A.A.) has had to meet an unprecedented challenge to provide new and updated airport pavement criteria. FAA's immediate action was to initiate R&D to respond to the most urgent needs with follow-up programs to fill in gaps in a proposed comprehensive plan. Efforts to date have been concerned with the three key areas of design, construction, and evaluation primarily under an interagency agreement with the U.S. Army Engineers Waterways Experiment Station, but involving other agencies and organizations. Research reports have already been prepared on criteria for multiple-wheel heavy-gear load aircraft (e.g., B-747), on keyways in airfield rigid pavements, and on airfield fibrous concrete. Additional reports on the other projects will be available as the R&D effort progresses. Results from these efforts will be actively considered for FAA's continuous updating of its airport pavement standards covering structural designs, materials, and construction. Author

N73-22206# Purdue Research Foundation, Lafayette, Ind.
LITERATURE SURVEY OF COLD WEATHER CONSTRUCTION PRACTICES
John A. Havers May 1972 181 p refs
(Contract DAAG23-68-C-0020)
(AD-745395; CRREL-SR-172; Rept-73-00843) Avail: NTIS HC $11.25 CSCL 13/13

Cold-weather construction practices were surveyed. The seasonality problem was defined and its economic and operational implications were identified. Cold weather construction tasks were examined for technological constraints and comparisons were made with existing military and civilian codes. Research and observations pertaining to the construction tasks being examined were listed to provide a base for current and future development of cold-weather construction techniques. An attempt was made to analyze the natural and technological constraints imposed by the weather on men, material, and equipment. The economic feasibility of cold-weather construction was examined by reviewing the recorded experience of many segments of the international construction industry, and the economic advantages of cold-weather construction were listed. It was concluded that 1) construction seasonality in the United States is a major economic problem; 2) reducing it and overcoming its effects are major tasks to be accomplished; and 3) cold-weather construction is not a panacea for seasonal unemployment, but would help to alleviate it. Author

N73-22207# Federal Aviation Administration, Washington, D.C. Aviation Forecast Div.
PROFILES OF SCHEDULED AIR CARRIER AIRPORT OPERATIONS. TOP 100 US AIRPORTS, FRIDAY 3 NOVEMBER 1972
Jan. 1973 308 p
(Rept-73-00328) Avail: NTIS HC $17.50

Data are provided for total scheduled air carrier aircraft operations by hour of the day for Friday, 3 November 1972, for the top 100 airports within the 50 states of the United States, the District of Columbia, and Puerto Rico. The selection of the top 100 airports was based on a ranking by number of air carrier passenger enplanements in domestic and international service. For each airport, two graphs are provided which depict total arrivals and departures by hour, and detail by hour for domestic trunk, local service, and international (U.S. and foreign flag) passenger operations, plus air taxi and all-cargo operations. Tabular listings of these data are also included. Author

N73-22208# Association of Bay Area Governments, Berkeley, Calif.
REGIONAL AIRPORT SYSTEMS STUDY, FINAL PLAN
Walter E. Gillfillan Jun. 1972 265 p refs Sponsored in part by HUD
(Rept-73-00316) Avail: NTIS HC $15.25

Recommendations for airport planning in the San Francisco Bay Area are presented in terms of projected annual passenger capacities through 1990. Workable plans for a comprehensive regional airport cooperative system include elements of citizen input, organizational influences, goals, decision criteria, and alternatives involved in air traffic policy making as set forth by the Association of Bay Area Governments. Cost estimates, implementation procedures, and long term forcasts of community impact constitute the thrust of the report. J.M.M.

N73-22209# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DERIVATION OF URBAN TACV NOISE LEVELS AND ENVIRONMENTAL EFFECTS Quarterly Progress Report, 17 Oct. 1971 - 31 Jan. 1972
15 Feb. 1972 46 p refs
(Contract DOT-TSC-329)
Avail: NTIS HC $4.50

An evaluation was made of noise control treatment planned for urban TACVs. Analytical and experimental investigations were made of cushion noise and turbulent boundary layer noise. E.H.W.

N73-22210*# TRW Systems Group, Redondo Beach, Calif.
MULTIWIRE PROPORTIONAL CHAMBER DEVELOPMENT Final Report, 1 Nov. 1970 - 31 Dec. 1972
R. F. Doolittle, U. Pollvogt, and A. J. Eskovitz Jan. 1973 116 p refs
(Contract ANS9-11315)
(NASA-CR-128899) Avail: NTIS HC $8.00 CSCL 14B

The development of large area multiwire proportional chambers, to be used as high resolution spatial detectors in cosmic ray experiments is described. A readout system was developed which uses a directly coupled, lumped element delay-line whose characteristics are independent of the MWPC design. A complete analysis of the delay-line and the readout electronic system shows that a spatial resolution of about 0.1 mm can be reached with the MWPC operating in the strictly proportional region. This was confirmed by measurements with a small MWPC and Fe-55 X-rays. A simplified analysis was carried out to estimate the theoretical limit of spatial resolution due to delta-rays, spread of the discharge along the anode wire, and inclined trajectories. To calculate the gas gain of MWPC's of different geometrical configurations a method was developed which is based on the knowledge of the first Townsend coefficient of the chamber gas. Author

N73-22211# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
EXPERIMENTAL SET-UP FOR WIND TUNNEL SIMULATION OF JETS [MONTAGE EXPERIMENTAL DE SIMULATION DE JET EN SOUFFLERIE]
C. Couedor 1972 21 p refs In FRENCH Presented at the 9th AAAF Colloq. on Aerodyn. Appl., Paris, Nov. 1972
(DGT-8352) Avail: NTIS HC $3.25

The test techniques are described which are used in simulating jet exhausts in low speed wind tunnels, in connection with the development of the V/STOL aircraft, Alpha-Jet. The several stages of development are described which have led to the present mounting of the aircraft model, without contact with the simulation circuit, and weighed with an internal balance. ESRO

N73-22212# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
AN EXAMPLE OF THE USE OF A PERFORATED VARIABLE GEOMETRY WIND TUNNEL [UN EXEMPLE D'UTILISATION DE SOUFFLERIE MUNIE DE PAROIS PERFOREES A GEOMETRIE VARIABLE]
M. Menard (Inst. Aerotech., Saint-Cyr) and Jean C. Vayssaire 1972 45 p refs In FRENCH Presented at the 9th AAAF Colloq. on Aerodyn. Appl., Paris, Nov. 1972
(DGT-8652) Avail: NTIS $4.25

A transonic wind tunnel is described, which has a mechanical system capable of continuously varying the permeability of the walls in longitudinal direction. This variable geometry offers numerous possibilities, notably the adustment of longitudinal pressure gradients of the air current, and also the realization of different porosities. The effects of permeable walls on a complete transport aircraft model are investigated. ESRO

N73-22213# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
PROJECT GUK (LARGE SUBSONIC WIND TUNNEL) [PROJEKT GUK. GROSSER UNTERSCHALL-KANAL]
R. Goethert (DFVLD, Brunswick) and B. Ewald Feb. 1973 16 p In GERMAN
(Rept-Ea-317-a) Avail: NTIS HC $3.00

The requirements for the design of a large subsonic wind tunnel are discussed. The dimensions and driving power are given, and the equipment is briefly described. Applications such as normal measurements at high Reynolds number, V/STOL, flutter and rotor measurements, are reviewed. ESRO

N73-22214# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTALLATIONS FOR LAUNCHING GUIDED MISSILES
Miro Boras and Stevan Roglio 16 Jan. 1972 20 p Transl. into ENGLISH from Vazduhoplovni Glasnik (Yugoslavia), v. 17, no. 1, 1960 p 60-72
(AD-756083; FTD-HC-23-634-72) Avail: NTIS CSCL 16/1

The report describes various facilities and support equipment used to launch surface-launched missiles. GRA

N73-22215# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
THE DEPENDENCE OF COMPRESSOR FACE DISTORTION ON TEST CELL INLET CONFIGURATION M.S. Thesis
Philip William Tower Dec. 1972 251 p refs
(AD-756540) Avail: NTIS CSCL 21/5

The aircraft turbine engine has evolved to the point that current static test facility designs require modification to provide adequate service and growth potential. Current design procedures are inadequate in that they do not provide methods for the prediction of flow uniformity at the increased thrust and air flow rates now being required. Through the testing of a multiplicity of inlet models the effect of test cell inlet configuration on engine distortion level is evaluated. A method is developed for the correlation of inlet design characteristics with experimentally observed distortion levels. Together with the evaluation of augmentor performance in an associated thesis by Lt. David L. Bailey, this tentative correlation provides a basis for the development of a practical system for the prediction of the performance of proposed test cell designs. Author (GRA)

N73-22923* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NEUTRAL BUOYANCY SPACE SIMULATION
James L. Splawn *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 107-111 (For availability see N73-22915 13-34)
CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-22216 Rice Univ., Houston, Tex.
A MODEL FOR PREDICTING THE PRESSURE WITHIN THE RECIRCULATION BUBBLE OF AN ATTACHED JET Ph.D. Thesis
William Jay Spargo 1972 63 p
Avail: Univ. Microfilms Order No. 72-26476

A model was developed to describe the flow field within the recirculation bubble of an attached jet. Goertler's velocity profile for a free jet was used to approximate the velocity along the dividing streamline, and triangular velocity profiles were used to describe the flow within the bubble. The model divided the recirculation bubble into a finite number of control volumes and assumed the pressure to be constant in a direction normal to the dividing streamline within the bubble. The conservation of mass and momentum was used to determine the pressure acting on each control volume. The pressures within the entire recirculation bubble were thereby predicted. The pressure profiles predicted by the model compared well with experimental pressure profiles. Dissert. Abstr.

N73-22217 Iowa Univ., Iowa City.
ON OSCILLATIONS OF VISCOUS SHOCK WAVE AND SONIC BOOM RISE TIME Ph.D. Thesis
Rajbir Singh Samra 1972 145 p
Avail: Univ. Microfilms Order No. 72-26730

The effect of the small amplitude periodic disturbances on the shock wave structure and the modifications in the sonic boom rise time due to the vibrations of the shock wave system of a supersonic transport are investigated. Mathematical analysis considers the model of the unsteady, plane viscous shock wave. Under small disturbance assumptions any flow variable, may be written as the sum of zero-order quantities, and the first-order perturbation quantities, etc. The Mach number considered varies from 1.1 to 3.0. The results indicate that a small amplitude disturbance at the lower edge of the shock wave decays exponentially in the shock wave structure. Frequency of oscillation does not effect significantly the amplitude of the disturbance in

the shock wave. The shock thickness varies with the amplitude of the disturbance, but is almost independent of the frequency range considered. The small disturbance analysis presented predicts the change of shock wave thickness and is not expected to predict the change in the position of the shock wave.
Dissert. Abstr.

N73-22218 Tennessee Univ., Knoxville.
ANALYSIS OF LAMINAR BOUNDARY LAYERS ON RIGHT CIRCULAR CONES AT ANGLE OF ATTACK, INCLUDING STREAMLINE-SWALLOWING EFFECTS Ph.D. Thesis
Arloe Wesley Mayne, Jr. 1972 107 p
Avail: Univ. Microfilms Order No. 72-27486

A method was developed for treating the three-dimensional compressible laminar boundary layer equations for the case of a right circular cone at angle of attack in supersonic and hypersonic flow. Swallowing by the boundary layer of the inviscid entropy layer, i.e., streamline swallowing, was treated by means of a mass flow balance between the inviscid and viscous flow fields. The boundary layer equations were developed in a general Crocco-variables form and particularized to the case of a right circular at angle of attack. A finite difference technique was formulated for solving the governing equations and treating the streamline swallowing phenomenon. The resulting second order accurate set of coupled nonlinear difference equations were solved in an iteration scheme which employed an efficient algorithm especially suited to their form. Results were presented which showed that, for sufficiently high Mach number and bow shock strength variations, streamline swallowing has a significant influence on computed boundary layer data. Dissert. Abstr.

N73-22219 Rice Univ., Houston, Tex.
THE PROPAGATION OF CURVED WAVES IN MIXTURES WITH SEVERAL TEMPERATURES Ph.D. Thesis
Robert Lawrence Rankin 1972 127 p
Avail: Univ. Microfilms Order No. 72-26464

The propagation of second and third order curved waves through a mixture of nonlinear elastic gases in which nonlinear diffusion is taking place is studied. The study treats nonlinear conductors as well as nonconductors. Four cases are considered. The propagation of second order waves through conductors and nonconductors and the propagation of third order waves through conductors and nonconductors are treated. In each case the propagation condition and the amplitude equation governing the growth and decay of the leading wave are derived.
Dissert. Abstr.

N73-22220 Cornell Univ., Ithaca, N.Y.
LASER-PRODUCED SPHERICAL SHOCK WAVES Ph.D. Thesis
Barrett Speddy Robb 1972 133 p
Avail: Univ. Microfilms Order No. 72-23870

An experimental study of laser-induced, hemispherical shock waves was carried out. A Q-switched ruby laser producing pulses of one to three joules energy with a half-width of 20 nanoseconds was focused on the surface of thick, solid targets of carbon or aluminum. The plasma produced was allowed to expand into an ambient atmosphere of argon or helium. The pressure of the ambient atmosphere was varied from 0.05 to 5 torr. Two gases were used in order that the effect of background pressure and density on the shock-wave motion could be determined independently. The deviation of the primary shock wave from ideal blast-wave behavior, and the trajectory of the secondary shock wave were studied. Dissert. Abstr.

N73-22221 State Univ. of New York, Buffalo.
ON LAMINAR BOUNDARY LAYER SEPARATIONS Ph.D. Thesis
Chun Hian Lee 1972 118 p
Avail: Univ. Microfilms Order No. 72-27260

Work covering three sections is presented: (1) the development of a coordinate expansion technique for the purpose of accomplishing quantitative solutions of nonlinear partial differential equations, (2) the qualitative analysis of Prandtl's boundary layer equations containing the point of zero skin friction, and (3) an investigation of laminar boundary layer separation phenomena. The technique proposed is established on the basis of the local invariance of a given partial differential equation under the action of certain local Lie group of point transformations. This technique is applied to study the problem of continuation of the steady, two-dimensional, incompressible boundary layer equations including the point of separation. A general class of potential flows in the form of power series is considered. As an example, a complete computation is carried out for the well known Howarth's linear potential profile. Dissert. Abstr.

N73-22222 Colorado Univ., Boulder.
THE STABILITY OF A THIN ELASTIC TUBE CONTAINING ROTATING FLUID FLOW Ph.D. Thesis
Ying-Chung Lai 1972 39 p
Avail: Univ. Microfilms Order No. 72-25189

The stability of a thin elastic tube of infinite length containing an inviscid, incompressible fluid flow was studied by using thin elastic shell theory and linear stability theory. The shell and fluid were in a rigid body rotation, while the fluid may also have a uniform axial motion. The equations of motion for the coupled shell-fluid system were solved by introducing a small perturbation on the tube wall in the form of a traveling wave. It was found that an empty tube without rotation is always in a stable state, whereas rotation causes the tube to become unstable and to vibrate at a lower natural frequency. The effect of rotation on the coupled shell-fluid system is demonstrated by a numerical example. For a rubber tube of given specifications containing water, it was found that when angular speed increases from zero to 1800 rpm, the effects of rotation are: (1) to reduce the critical axial fluid speed; (2) to change the most unstable mode m from 6 to 3;(3) to increase the corrresponding wave number and frequency; (4) to increase the circumferential wave speed and to decrease the axial wave speed. Dissert. Abstr.

N73-22223 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL INVESTIGATION OF A JET ISSUING FROM A WING IN CROSSFLOW Ph.D. Thesis
William Theodore Mikolowsky 1972 249 p
Avail: Univ. Microfilms Order No. 72-26312

The aerodynamic interference resulting from a jet issuing normal to the chordal plane of a two-dimensional wing in a crossflow has been experimentally investigated. The primary purpose of this work was to provide a link between previous investigations of a jet issuing into a crossflow from an infinite flat plate and the numerous experiments in which the aerodynamic characteristics of V/STOL aircraft configurations in transitional flight were determined. Dissert. Abstr.

N73-22224 Minnesota Univ., Minneapolis.
ON THE FLOW OF A RAREFIED GAS IN A LONG CYLINDRICAL CAPILLARY Ph.D. Thesis
Bruce Franklin Abramson 1972 91 p
Avail: Univ. Microfilms Order No. 72-27718

Transition Poiseuille flow through a long cylindrical capillary is analyzed. The flow is considered steady and may be characterized by a dilute monatomic gas proceeding from an upstream rear-continuum state to a downstream free molecular state. The density is presumed to change slowly throughout the transition region between these end states. A solution is found for the transition density, in addition to a correction for the free molecular end of the capillary. The transition density solution is based on a successive approximations treatment of the Bhatnagar, Gross, and Krook model equation using small mass flow rate as a perturbation parameter. The analysis yields a separable differential equation which is solved numerically for the transition density profile. The free molecular end correction to the transition density involves treatment of the Clausing integral equation as a singular integral equation which is solved by the method of Wiener-Hopf. An asymptotic solution is found for the free molecular end density. Dissert. Abstr.

N73-22225 Ohio State Univ., Columbus.
INVESTIGATION OF RIBBED DIFFUSERS Ph.D. Thesis
Frank Donald Stull 1972 447 p
Avail: Univ. Microfilms Order No. 72-27119

Water table flow visualization tests of a two-dimensional straight wall diffuser and a corresponding ribbed diffuser were conducted over a wide range of diffuser total angles (2 theta = 0 deg to 100 deg) and diffuser length to width ratios (N/W sub 1 = 2.4 to 24). Flow regimes were identified using the

needle trace technique of Fox and Kline. Rib parameters such as inter-rib depth to width ratio, inter-rib width, rib thickness, and number of ribs were varied, as well as rib contour. Motion pictures were obtained of the vortexes and secondary flow patterns occurring within the inter-rib cavities, and hot film measurements were made to determine the extent of the velocity fluctuations induced by the ribs. The most promising configuration for delaying separation was obtained when a single large cavity replaced the ribbed section of the diffuser. Dissert. Abstr.

N73-22226 Rutgers Univ., New Brunswick, N.J.
INCOMPRESSIBLE TURBULENT SEPARATION FROM AN AXISYMMETRIC CURVED AFTERBODY Ph.D. Thesis
Chang-Han Yi 1972 197 p
Avail: Univ. Microfilms Order No. 72-27615

Separation of an incompressible turbulent boundary layer from an axisymmetric curved afterbody was studied experimentally. A semi-ellipsoidal base of axis ratio 4 to 1 was attached to a cylindrical model with a nominal diameter of 2-1/2 inches. An induction type low turbulence subsonic wind tunnel with a closed test section was used for the experimental investigation. The free stream mean velocity was 155 ft/sec with corresponding Reynolds number of 939,000 per foot and Mach number of 0.136. Measurements were made in the approaching boundary layer, separated region, shear layer, and far-wake region by various pressure and hot-wire probes. The stagnation and static pressure profiles in these regions were obtained and comparisons were made to blunt base data. Dissert. Abstr.

N73-22227 Clarkson Coll. of Technology, Potsdam, N.Y.
LAMINAR CONVECTIVE TRANSPORT PROCESSES IN STRONGLY CURVED TUBES Ph.D. Thesis
Tsyh-Shyong Lin 1972 193 p
Avail: Univ. Microfilms Order No. 72-25720

The equations of motion for incompressible laminar flow in strongly curved tubes are solved by two approximate techniques: a combined Fourier series - numerical method for small Reynolds numbers and a boundary layer method for Reynolds numbers. It is found that the friction factor ratio for smaller curvature ratios is greater than that for larger curvature ratios at the same Reynolds number since the secondary flow is more intense for smaller curvature ratios than for larger curvature ratios. The upper and lower limits of Reynolds numbers for which the power series method and the boundary layer model apply respectively are determined. Furthermore, the flux ratio at the same pressure gradient, the friction factor ratio at the same Reynolds number, the point velocity and the stream functions are given. The problem of laminar dispersion in strongly curved tubes is studied and extended to larger Reynolds numbers than previously available by the Fourier series method. Dissert. Abstr.

N73-22228 California Univ., San Diego.
STUDIES OF COMPRESSIBLE LAMINAR BOUNDARY LAYERS. 1: THE BOUNDARY LAYER ON A CONE NEAR A PLANE OF SYMMETRY. 2: THE STAGNATION POINT BOUNDARY LAYER WITH HYDROGEN INJECTION Ph.D. Thesis
Peter Kwong-Shang Wu 1972 120 p
Avail: Univ. Microfilms Order No. 72-24642

A detailed study of the similarity solutions to the boundary layer equations for the plane of symmetry of a cone in supersonic and hypersonic flows and a finite difference method to the similar stagnation point flow with hydrogen injection and finite chemistry are presented. The compressible laminar boundary layer near the plane of symmetry of a cone with either outflow or inflow is considered. New solution branches were discovered. Solutions which are provided for ranges of pertinent similarity variables exhibit nonuniqueness for both outflow and inflow. Also, there exists a range of values of similarity variables in which nonexistence of similarity solutions prevails. Discussion is made of the behavior of the boundary layer at an axisymmetric stagnation point with hydrogen injection into a hot external airstream to span the entire range from essentially frozen to essentially equilibrium flow. Dissert. Abstr.

N73-22229 Johns Hopkins Univ., Baltimore, Md.
AN EXPERIMENTAL STUDY OF THE GROWTH OF MECHANICALLY GENERATED SURFACE WATER WAVES WHEN SUBJECTED TO A FULLY DEVELOPED TURBULENT CHANNEL AIRFLOW Ph.D. Thesis
William Stanley Wilson 1972 102 p
Avail: Univ. Microfilms Order No. 72-24985

An experimental study was conducted to measure the growth rates of mechanically generated surface water waves when subjected to fully developed turbulent channel airflow. The study was designed to test the accuracy of the growth rates predicted by the Miles' 1962 Theory. For a series of wave frequencies (from 2 to 6 Hz at 0.5-Hz increments) and centerline wind velocities (0.20, 1.12, and 1.84 m/s) wave amplitudes were measured at three stations (2.21, 3.43, and 4.65m) downwind from the wave generator. In addition, for centerline velocities of 1.12 and 1.84 m/s, U sub 1 (the velocity at the outer edge of the viscous sublayer) and U sub * (the shear velocity) were obtained from measured mean velocity and Reynolds stress profiles. The wave amplitude measurements at the wind velocity of 0.20 m/s provided attenuation rate estimates which agreed reasonably well with theoretical attenuation rates based on viscous effects both on the walls and in the bulk of the water. Dissert. Abstr.

N73-22230 Lehigh Univ., Bethlehem, Pa.
A STUDY OF FLOW FIELDS IN BISTABLE FLUID AMPLIFIERS Ph.D. Thesis
Walter Barry Wagner 1972 465 p
Avail: Univ. Microfilms Order No. 72-25900

The three-dimensional nature of the flow fields in planar nozzles and wall jets found in bistable fluid amplifiers was investigated. Detailed total pressure measurements were made at the exit plane of nozzles having convex wall curvature for cases with flow supplied perpendicular and parallel to the nozzle exit flow direction. Significant low total pressure regions in the corners of the nozzles caused by sidewall boundary layer cross-flow in the vicinity of the convex nozzle walls were found in both cases. Midplane total pressure loss regions were found in the parallel supply flow case only. The flow in a vented amplifier design with perpendicular supply flow was studied at an aspect ratio of 4. Total pressure loss regions and the asymmetry with respect to the midplane present at the power jet nozzle exit were found to affect the wall jet flow. The outer layer of the wall jet was significantly affected by the presence of a passive attachment wall and other amplifier components. Dissert. Abstr.

N73-22231 Oregon State Univ., Corvallis.
CONCENTRATION AND VELOCITY PROFILES FOR FLOW-COUPLED DIFFUSION Ph.D. Thesis
David Earl Stock 1972 136 p
Avail: Univ. Microfilms Order No. 72-27643

Diffusion in steady laminar flow of a mixture of two gases in a circular duct with no net flow of one of the gases was considered. The diffusing gas was introduced at a plane and diffused against the flow, resulting in flow-coupled diffusion. High Peclet Numbers (0.2 to 8.0) were considered and the resulting concentration and velocity profiles were investigated. A two-dimensional analytical model was developed which incorporated an approximate velocity profile, the molar continuity equation, and Fick's Law. Velocity profiles were approximateld by assuming an even power series and using boundary conditions at the wall and centerline to solve for the constants. Resulting equations were solved numerically to determine the concentration field. Results are presented as curves showing the percent difference between the two-dimensional and the plug-flow analyses as a function of the Peclet Number, the injection plane concentration, and the molecular weight of the gases. Dissert. Abstr.

N73-22232 University of Southern Calif., Los Angeles.
VORTEX FORMATION, FREE SURFACE DEFORMATION, AND FLOW FIELD STRUCTURE IN THE DISCHARGE OF LIQUID FROM A ROTATING TANK Ph.D. Thesis
Donald Fred Gluck 1972 260 p
Avail: Univ. Microfilms Order No. 72-27658

A predominantly experimental investigation was completed on the discharge of liquid from a partly full, rotating, right-cylindrical tank, whose axis was parallel to the local vertical, through an axisymmetric outlet in the tank base. Liquid, initially in solid body rotation, was pumped from the tank in a step function manner; tank rotation and liquid efflux rate were

maintained essentially constant during the transfer. Measurements were made of free surface deformation and fluid velocities using various tracer techniques including dye, hydrogen bubbles, and neutrally buoyant liquid droplets with data recorded photographically. In the first series of experiments, centerline deformation was characterized as a function of geometry, and Rossby, Reynolds, and Froude numbers. In the final experimental series the quasisteady flow was studied in detail for two test conditions. Dissert. Abstr.

N73-22233*# Notre Dame Univ., Ind. Aerospace Lab.
SEPARATION OVER A FLAT PLATE-WEDGE CONFIGURATION AT OCEANIC REYNOLDS NUMBERS
David R. Campbell (ARL) 8 May 1973 32 p refs Sponsored by NASA Backup Document for AIAA Synoptic scheduled for publication in Journal of Hydronautics in October 1973
(NASA-CR-131888; LOG-H260) Avail: NTIS HC $3.75 CSCL 20D

An experimental study of flow over a two-dimensional flat plate-wedge configuration is presented. The investigation encompasses a range of Reynolds numbers characteristics of conditions encountered by deep submersible oceanic vehicles. Flow separation, similar to that found on high speed aircraft control surfaces, is reported and discussed in light of the laminar or transitional nature of the separated shear layer. As discovered in previous high Mach number studies of plate-wedge or ramp configurations, the dependency of the size of the separated region on free stream Reynolds number is reversed for laminar and transitional types of flow separation. Author

N73-22234# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
DIGITAL PDP-15 COMPUTER METHOD FOR LINEARING HOT FILMS SIGNALS AND ITS APPLICATION TO TURBULENT CHANNEL FLOW MEASUREMENTS Ph.D. Thesis - Goettingen Univ. [EINE METHODE ZUR LINEARISIERUNG VON HEISSFILMSIGNALEN MIT DEM DIGITALRECHNER PDP-15 UND IHRE ANWENDUNG BEI MESSUNGEN IN EINER TURBULENTEN KANALSTROEMUNG]
Hans-Peter Kreplin 1973 87 p refs In GERMAN
(Rept-2/1973) Avail: NTIS HC $6.50

A digitalization method for linearizing hot film signals is described and applied to single component measurements in turbulent channel flows. Oil channel flow calculations agree with analog measurements up to the maximum distribution level. Distributions of skewness and flatness factors in longitudinal oscillations are determined for the half channel width.
Transl. by G.G.

N73-22235*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE TURBULENT MEAN-FLOW, REYNOLDS-STRESS, AND HEAT FLUX EQUATIONS IN MASS-AVERAGED DEPENDENT VARIABLES
Morris W. Rubesin and William C. Rose Mar. 1973 32 p refs
(NASA-TM-X-62248) Avail: NTIS HC $3.75 CSCL 20D

The time-dependent, turbulent mean-flow, Reynolds stress, and heat flux equations in mass-averaged dependent variables are presented. These equations are given in conservative form for both generalized orthogonal and axisymmetric coordinates. For the case of small viscosity and thermal conductivity fluctuations, these equations are considerably simpler than the general Reynolds system of dependent variables for a compressible fluid and permit a more direct extension of low speed turbulence modeling to computer codes describing high speed turbulence fields. Author

N73-22236*# Stanford Univ., Calif. Dept. of Applied Mechanics.
INSTABILITIES OF A SPATIAL SYSTEM OF ARTICULATED PIPES CONVEYING FLUID
Michael P. Bohn and George Herrmann Jun. 1972 37 p refs (Grants NGL-05-020-397; AF-AFOSR-1905-70; AF Proj. 9782)
(NASA-CR-131605; AD-746699; SUDAM-72-8; AFOSR-72-1107TR) Avail: NTIS HC $4.00 CSCL 20/4

A spatial system of two articulated pipes conveying fluid is examined analytically and experimentally. As the flowrate is increased, stable equilibrium is studied for either divergence (static buckling) or by flutter (oscillations with increasing amplitude), depending upon the value of an angle beta which measures the out-of-planeness of the system. It is found that in the range between zero and 90 degrees there exists a transition value of beta below which stability is lost by flutter and above which stability is lost by divergence. Author (GRA)

N73-22237# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TURBULENT BOUNDARY LAYER WITH INJECTION OF THE SAME OR A DIFFERENT GAS THROUGH A POROUS WALL
Taieb Lili 1972 137 p refs In FRENCH; ENGLISH summary
(ONERA-NT-201) Avail: NTIS HC $9.00

The theoretical study presented is based on an improved mixing length model which is used to determine friction, heat flux, and diffusion flux in an entire boundary layer. Numerical methods for solving the boundary layer equations utilizing the equilibrium assumption, the local similitude assumption, and a finite element technique demonstrate that the mixing length model affords a correct prediction of boundary layer development. In addition, the results of an experimental study involving the injection of carbon dioxide into an incompressible flow provided the determination of the turbulent Schmidt number, as well as confirmation of the validity of the improved mixing length model. Author

N73-22238# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
TWO CALCULATION PROCEDURES FOR STEADY, THREE-DIMENSIONAL FLOWS WITH RECIRCULATION
L. S. Caretto, A. D. Gosman, S. V. Patankar, and D. B. Spalding Jun. 1972 25 p refs
(EF/TN/A/47) Avail: NTIS HC $3.25

Two procedures are described for solving the Navier-Stokes equations for steady, fully three-dimensional flows: both are extensions of earlier methods devised for three-dimensional boundary layers. The procedures differ in their manner of solving the difference equations. The SIVA (for simultaneous variable adjustment) procedure, which is fully implicit, uses a combination of algebraic elimination and point-successive substitution, wherein simultaneous adjustments are made to a point pressure and the six surrounding velocities, such that the equations for mass and (linearized) momentum are locally satisfied. The SIMPLE (for semi-implicit method for pressure-linked equations) method proceeds in a successive guess-and-correct fashion. Each cycle of iteration entails the calculation of an intermediate velocity field which satisfies the linearized momentum equations for a guessed pressure distribution: then the mass conservation principle is invoked to adjust the velocities and pressures, such that all of the equations are in balance. Author

N73-22239*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF COMPRESSIBLE-FLOW PRESTON TUBE CALIBRATIONS
Jerry M. Allen Washington May 1973 67 p refs
(NASA-TN-D-7190; L-8733) Avail: NTIS HC $3.00 CSCL 20D

An experimental and analytical study has been made of the accuracy of various Preston tube calibration equations to determine local skin friction in two-dimensional supersonic and low-hypersonic flows. Experimental Preston tube calibration data from the present and previous studies were used to evaluate the calibration equations. The maximum value of the calibration parameters of the present data is more than an order of magnitude larger than that previously obtained; thereby, the evaluation of the various calibration equations is facilitated. The Preston tube technique was found to be very inaccurate in the low range of the calibration parameters. Above this range, there was a steady increase in accuracy with increasing values of the calibration parameters. No critical maximum tube diameter was found even with tubes about twice as large as the theoretical maximum allowable diameter. Of the two forms of the calibration equation previously existing, the logarithmic laws gave more accurate results than the power laws over an extended range of the calibration parameters in supersonic adiabatic flow. Author

N73-22240# Cambridge Univ. (England). Dept. of Engineering.
DISCRETE FREQUENCY SOUND GENERATION IN AXIAL FLOW TURBOMACHINES
S. N. Smith London Aeron. Res. Council 1973 58 p refs Supersedes ARC-33574
(ARC-R/M-3709; ARC-33574) Avail: NTIS HC $5.00; HMSO £2.10; PHI $8.20

A calculation method is described for unsteady, subsonic flow through an infinite, two-dimensional cascade of flat plate blades at zero mean incidence. The unsteady blade lift and moment, generated acoustic waves, and shed vortex wakes can be calculated when the blades are subjected to bending or torsional vibration, incoming acoustic waves, or convected wake velocity perturbations. The results are in good agreement with those obtained by existing methods, and demands upon computer time and storage are slight. Measurements were made of the acoustic waves generated by a single compressor rotor excited by a convected wake velocity perturbation, with the blades in both an unloaded and a loaded condition. Agreement between theory and experiment is good in the unloaded blade case, but the present theory is inadequate to deal with the extra sound sources introduced by blade steady loading, and underestimates the generated wave amplitude in this case. Author (ESRO)

N73-22241# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
APPROXIMATE DETERMINATION OF JET CONTOURS NEAR THE EXIT OF AXIALLY SYMMETRICAL NOZZLES AS A BASIS FOR PLUME MODELING
H. H. Korst 18 Aug. 1972 22 p refs
(DA Proj. 1M2-62303-A-214)
(AD-756380; RD-TR-72-14) Avail: NTIS CSCL 20/4

A simple, approximate method is presented for rapid determination (utilizing mini-computers) of plume shapes produced by jet expansion from axially symmetric nozzles. The analysis is based on concepts developed by Johannesen and Meyer. It is shown how the method for plume shape determination can be utilized to model at least the geometric aspects of prototype plumes as well as to account for significant inviscid and viscid aspects of the base flow problem. A calculation procedure and numerical examples are presented to guide the reader in applying the modeling technique. Author (GRA)

N73-22242# Naval Weapons Lab., Dahlgren, Va.
MACHINE CALCULATION OF UNSTEADY MACH REFLECTIONS AND PRANDTL-MEYER SUPERSONIC FLOWS
J. J. Yagla Jan. 1973 35 p refs
(AD-756195; NWL-TR-2897) Avail: NTIS CSCL 20/4

A new finite difference method, which employs a transformation of coordinates, has been used to calculate the interaction of a traveling shock wave with a wedge. The steady flow counterparts to this problem, Prandtl-Meyer compressions and expansions, have also been solved with the new method. The results of the calculations are compared with the experimental data of Dewey (1972) for the unsteady case of Mach reflection over a wedge. The results of the calculations for steady Prandtl-Meyer expansions and compressions are compared with results obtained from exact theory. The calculations are noted to differ from the theoretically correct values by differences on the order of one percent for the pressure, velocity, density, and Mach number. Author (GRA)

N73-22243# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INVESTIGATION OF THE SWITCHING MECHANISM IN BISTABLE AMPLIFIERS Final Technical Report
Guy A. P. M. Bekaert and Mario Carbonaro Dec. 1972 82 p refs
(Contract DAJA37-72-C-0583)
(AD-756583) Avail: NTIS CSCL 13/7

The purpose of the study was to investigate, for various geometries, the relative importance of the mass and the momentum of the control signal on the switching time of bistable amplifiers and the movement of the reattachment point of a jet reattached to a wall. Different ratios of the mass to the momentum of the control flow have been obtained by using control gases of different densities. The flow field study included control velocity and wall pressure measurements during switching in bistable amplifiers as well as during the movement of the reattachment point for a jet reattachment to a wall. The results indicate that the momentum flux ratio of control to supply flow is a much more important parameter in determining the flow evolution than the mass flux or volume flux ratio. Author (GRA)

N73-22244# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
A HOT-WIRE ANEMOMETER STUDY OF FREE TURBULENT MIXING IN AXIAL PRESSURE GRADIENTS M.S. Thesis
Michael Erwin Kearney Dec. 1972 257 p refs
(AD-756543) Avail: NTIS CSCL 20/4

The report was prepared to describe the results of an experimental study of free turbulent mixing in axial pressure gradients. Both the pressure field and the velocity field were extracted using pitot-static probes and both a single normal wire and an X-array hot-wire anemometer. The resulting hot-wire data present an excellent visual representation of the physical aspects of turbulent flow. An analysis of the results shows that the Reynolds stresses in the flow are related by function to the turbulent kinetic energy. Author (GRA)

N73-22245# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
CREATION OF SPHERICAL SHOCK WAVE IN THE ATMOSPHERE BY USING A SHOCK TUBE
Samuel Lederman, Edward F. Dawson, and Prem K. Khosla Dec. 1972 30 p refs
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-756455; PIBAL-72-38) Avail: NTIS CSCL 20/4

The behavior of shock heated Argon expanding through a nozzle into the still atmosphere was investigated. It was found that any attempt to control or shape the emitted slug of hot gas to form a spherical bubble was unsuccessful, that a spherical weak shock propagated in front of the hot slug of gas, and that the flow was highly turbulent. Author (GRA)

N73-22246# Naval Postgraduate School, Monterey, Calif.
THE APPLICATION OF HOLOGRAPHIC INTERFEROMETRY TO THE DETERMINATION OF DISCONTINUOUS THREE DIMENSIONAL DENSITY FIELDS M.S. Thesis
Paul Edgar VanHouten Dec. 1972 70 p refs
(AD-756535) Avail: NTIS CSCL 20/4

A Fourier transform method is used to invert the integral equation resulting from holographic interferometry of three-dimensional weakly refractive phase objects. The inverted equation is applied to the determination of aerodynamic density fields. The effects of various numerical techniques are extensively evaluated in an attempt to minimize computational effort. Numerical filtering techniques are introduced in order to handle the discontinuities associated with supersonic aerodynamic phenomena. GRA

N73-22247# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF HOLOGRAPHIC INTERFEROMETRY TO DENSITY FIELD DETERMINATION IN TRANSONIC CORNER FLOW M.S. Thesis
Robert Anthony Kosakoski Dec. 1972 122 p refs
(AD-756534) Avail: NTIS CSCL 20/4

The successful application of holographic interferometry to the study of density fields around opaque bodies in wind tunnel experiments has been reported in the literature. The present report extends this technique to the study of the three-dimensional asymmetric flow fields encountered near the wing-fuselage junction of an aerodynamic model in the transonic flow regime. Finite fringe interferometry has been used to obtain fringe information about a partially transparent wind-body structure. A FORTRAN computer program was used to invert the fringe information and produce a plot of the density field around the model. The resulting asymmetric density field and shock wave structure are shown to be an accurate representation of the phenomena encountered in aerodynamic corner flow. Author (GRA)

N73-22248# Yale Univ., New Haven, Conn.
EFFECTS OF NOZZLE GEOMETRY AND DIAPHRAGM LOCATION ON THE STARTING PROCESS IN A LUDWIEG TUBE Final Report, Jul. 1971 - Jun. 1972

Leo T. Smith and Francis Mosnier Arnold Air Force Station, Tenn. AEDC Feb. 1973 52 p refs
(Contract F40600-70-C-0008)
(AD-755357; AEDC-TR-73-21) Avail: NTIS CSCL 14/2

The starting process in the Ludwieg tube, an intermittent type wind tunnel, was experimentally investigated. Starting flow with varying initial supply gas pressure, nozzle geometry, and downstream diaphragm location, was studied. Two types of closed jet nozzle configurations were used: uniform flow M = 1.6 nozzles, and wedge type M = 1.6 nozzles. Dry air at 1, 2, and 3 atm pressure and room temperature served as the test gas. Starting times were determined from static pressure recordings, made at the exit of the nozzle, and the presence or absence of starting shock waves was confirmed by high speed shadowgraph films of the flow. A dimensional analysis that relates nozzle starting time to the supply conditions, nozzle inlet angle, nozzle contraction ratio, and distance to the diaphragm was performed, and it was found to correlate the measurements. Author (GRA)

N73-22249# California Inst. of Tech., Pasadena. Firestone Flight Sciences Lab.
HYPERSONIC RESEARCH PROJECT Final Report, 1 Nov. 1962 - 30 Sep. 1972
Lester Lees and Toshi Kubota 30 Sep. 1972 21 p refs
(Contract DA-31-124-ARO(D)-33; AROD Proj. P-1600-E)
(AD-755276; AROD-1600-112-E) Avail: NTIS CSCL 20/4

The report summarizes the following theoretical and experimental investigations: (A) Hypersonic and rarefied gas flows, wakes, separated and reattaching flows, viscous flow, laminar and turbulent boundary layers with strong blowing, supersonic turbulent mixing layer, and kinetic theory description of rarefied gas flows. (B) Flow of ionized gases, theory of weakly ionized gases, low-intensity discharge transverse to a hypersonic stream, an arc-heated wind tunnel, collision-free plasmas, and non-equilibrium phenomena in low-density arc jets. Author (GRA)

N73-22250# Naval Ship Research and Development Center, Bethesda, Md.
ANALYTICAL PREDICTION OF WALL EFFECT ON FULLY CAVITATING LIFTING FOILS, USING NONLINEAR THEORY
Elwyn S. Baker Nov. 1972 150 p refs
(AD-755423; NSRDC-3688) Avail: NTIS CSCL 13/10

A FORTRAN computer program, compatible with the CDC 6000 series, has been developed to evaluate the effect of a closed-jet tunnel-test section on the force coefficients of arbitrarily cambered, sharp-nosed, fully cavitating, two-dimensional hydrofoil sections. The numerical solution to this problem has been obtained using the nonlinear theory developed by T. Y. Wu in 1969. The theory employs an open-wake model, commonly called the Roshko or transition-wake model, to represent the cavity downstream of the foil section. Results of the program include predicted force coefficients, streamline shapes and pressure coefficient distributions. Some comparisons are made with the predictions of two other nonlinear theories available for the infinite-stream case only. Author (GRA)

N73-22251# California Univ., La Jolla. Inst. for Pure and Applied Physical Sciences.
RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS Semiannual Technical Status Report, 1 Apr. - 30 Sep. 1972
S. C. Lin 30 Sep. 1972 49 p refs
(Contract DAHC04-72-C-0037; ARPA Order 570)
(AD-755273; ARUD-10757-12-P) Avail: NTIS CSCL 20/4

Contents: Wake turbulence and atmospheric boundary layers; Turbulent mixing and shear flows; High-temperature gas dynamics; Ionospheric physics; Laser propagation and advanced technology; Laser diagnostics and interactions. GRA

N73-22252# California Univ., Berkeley. Coll. of Engineering.
A VARIATIONAL METHOD IN POTENTIAL FLOWS WITH A FREE SURFACE Final Technical Report
Kwang June Bai Sep. 1972 148 p refs
(Contract N00014-69-A-0200-1048; SR0090101)
(AD-755465; NA-72-2) Avail: NTIS CSCL 20/4

The steady oscillatory irrotational motion of an inviscid incompressible fluid is described by a boundary-value problem of elliptic type. A variational form of this problem has been made here the basis of a numerical method. The problem is simplified assuming that the amplitudes of the generated waves are small compared with their wave lengths. The numerical satisfaction of the radiation boundary condition has been investigated. Some sample problems with known solutions have been treated first in order to test the method. All the results for two-dimensional motion and for heaving motion of an axisymmetric body in infinite or finite depths show very good agreement with existing results. In addition, some diffraction problems in two dimensions with homogeneous fluid or stratified fluids are solved, and also a problem with nonuniform depth. Author (GRA)

N73-22253# Oceanics, Inc., Plainview, N.Y.
DETERMINATION OF STABILITY DERIVATIVES OF HYDROFOIL CRAFT VIA SYSTEM IDENTIFICATION Final Report
Paul Kaplan and Theodore P. Sargent Oct. 1972 77 p refs
(Contract N00014-71-C-0059)
(AD-755738; Rept-72-93) Avail: NTIS CSCL 13/10

The capability of applying a sequential estimation technique of system identification to determine unknown coefficient values in the vertical plane equations of motion for a hydrofoil craft is investigated where the craft has random forcing functions and/or measurement noise contamination. Results are obtained from experiments using trajectory data supplied from computer simulation (with known coefficient values) as well as from full scale measurements. The utility of the method and the construction of mathematical models are described. Author (GRA)

N73-22254# Naval Research Lab., Washington, D.C.
INTERNAL WAVE GENERATION BY SUBMERGED BODIES: MEAN FLOW EFFECTS Interim Report
Thomas H. Bell, Jr. Jan. 1973 36 p refs
(NRL Proj. K03-11)
(AD-755714; NRL-MR-2553) Avail: NTIS CSCL 20/4

The basic physical processes which are associated with the passage of a body thru a density stratified environment and which result in disturbance motions which are steady in a reference frame moving with the body are systematically investigated. A comparison of the relative internal wave-making efficiency of the various mechanisms is made, based on the internal wave energy production rates associated with the mechanisms as functions of the sensible parameters of the problem. Author (GRA)

N73-22255# Illinois Univ., Urbana. Water Resources Center.
TRANSPORT PROCESSES OF PARTICLES IN DILUTE SUSPENSIONS IN TURBULENT WATER FLOW, PHASE 2 Final Report, 1 Jul. 1969 - 30 Sep. 1972
Barclay G. Jones, Charles C. Meek, Neil Howard, Kombiz Salehi, and Papa Rao Meka Sep. 1972 134 p refs
(Contract DI-14-31-0001-3077)
(PB-213536; UILU-WRC-73-0058; OWRR-B-042-ILL(1)) Avail: NTIS CSCL 20D

An increased understanding of particle motion in a turbulent fluid field has been achieved both in an analytical and in an experimental sense. Analytically, a theory simplified by the restrictive constraints of isotropy was developed. Assumption of a reasonable particle energy spectrum allowed calculation of various statistical quantities important in the determination of the particle's turbulent motion. By such an analysis three characterizing parameters were found. Two describe inertial effects due to the particle's size and density. The crossing of the particle from one region of correlated fluid turbulence to another by virtue of its free fall velocity is described by the third. Analysis of the particles' behavior in the turbulent flow gave a three-dimensional characterization of their motion. GRA

N73-22256# Army Foreign Science and Technology Center, Charlottesville, Va.
TEMPERATURE PROFILES IN TURBULENT BOUNDARY LAYER OF VARIOUS FLUIDS AT THE WALL
A. Slanciauskas and M. R. Drizius 10 Jan. 1973 21 p refs Transl. into ENGLISH from Tr. Akad. Nauk Lit. SSR, Ser. B (Vilna), no. 1, 1971 p 189-203
(AD-756957; FSTC-HT-23-2093-72) Avail: NTIS CSCL

20/13

The investigation of heat transfer in the immediate vicinity of the wall by measurement of average temperature profiles was the main subject of the present work. Temperature profiles were measured in liquid flows with various Prandtl numbers (Pr), with the aim of determining the interaction of turbulent and molecular transport at various distances from the wall. In this investigation, the analysis is based on the universality of the distributions of the average flow characteristics in a turbulent boundary layer. Author (GRA)

N73-22257# Army Foreign Science and Technology Center, Charlottesville, Va.

INVARIANT-GROUP PROPERTIES OF EQUATIONS FOR A BOUNDARY LAYER OF AN ELECTRICALLY CONDUCTIVE LIQUID

S. A. Derbenev 16 Jan. 1973 11 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. (Kazan), no. 125, 1970 p 28-35 (AD-756956; FSTC-HC-23-2085-72) Avail: NTIS CSCL 20/4

The investigation described in the report is concerned with finding a basic group G of a system of equations for a laminar boundary layer of conductive liquid in a magnetic field. Author (GRA)

N73-22258# Aeronautical Research Associates of Princeton, Inc., N.J.

TRANSITION RUN-OUT CALCULATIONS FOR A COMPRESSIBLE BOUNDARY LAYER WITH WALL COOLING Final Report, 3 Jan. - 4 Oct. 1972

John E. Yates and Coleman Donaldson Oct. 1972 43 p refs (Contract F33615-72-C-1350; AF Proj. 1366) (AD-756890; ARAP-183; AFFDL-TR-72-123) Avail: NTIS CSCL 20/4

An analytic model developed for the study of transition in a compressible boundary layer is used to make comprehensive transition run-out calculations for Mach numbers between 0 and 12 and wall temperature ratios between 0.05 and 1.2. Calculated results for the transition Reynolds number and the minimum critical Reynolds number for a growing boundary layer are compared with previous calculations for a frozen uniform parallel flow and with experimental transition results. The theory predicts the beginning of transition at the outer edge of the boundary layer for hypersonic Mach numbers, in agreement with experimental findings. Author (GRA)

N73-22259# Wisconsin Univ., Madison. Mathematics Research Center.

THE TWO-PHASE STOKES FLOW OF TWO IMMISCIBLE FLUIDS

K. B. Ranger Jan. 1973 33 p refs (Contract DA-31-124-ARO(D)-462) (AD-756341; MRC-TSR-1271) Avail: NTIS CSCL 20/4

The two-phase flow of two immiscible fluids is considered for motion in a diverging channel. The interest centers on Reynolds number effects and the manner in which the lubricant fluid modifies the onset of laminar separation. Some related two-phase flows are also described for streaming and rotating Stokes flows in the presence of a sphere, and calculations are given for the modified torque and drag formulas. Author (GRA)

N73-22260# Notre Dame Univ., Ind. Coll. of Engineering.

THE EFFECTS OF A DRAG REDUCING POLYMER ON THE TURBULENT BOUNDARY LAYER OF A SUBMERGED FLAT PLATE

Stanley M. Kumor and Nicholas D. Sylvester Jan. 1973 122 p refs (Contract N00014-68-A-0152; NR Proj. 260-112) (AD-755215; UND-73-1) Avail: NTIS CSCL 20/4

The primary objective of an experimental investigation was to study the effect that a drag-reducing polymer has on the turbulent boundary layer of a submerged flat plate using a Laser-Doppler flowmeter. Data are presented showing the time effects caused by polymer solution drag-reduction degradation on the mean velocity and axial fluctuating-velocity profiles. The importance of the data is that it provides a connection between the apparently diverse results reported previously for the velocity profiles at conditions of high and low drag-reduction effectiveness. The polymer molecules effect on the boundary layer structure is apparently progressively restricted to the near wall region with decreasing drag reduction in agreement with the mean velocity profiles. Author (GRA)

N73-22261*# Brown Univ., Providence, R.I. Center for Dynamical Systems.

THE ENTROPY RATE ADMISSIBILITY CRITERION FOR SOLUTIONS OF HYPERBOLIC CONSERVATION LAWS

Constantine M. Dafermos Oct. 1972 19 p refs (Grant NGL-40-002-015; Contract N00014-67-A-0191-0009; NR Proj. 041-397; RR0030101) (NASA-CR-131812; AD-752157) Avail: NTIS HC $3.00 CSCL 12/1

The following admissibility criterion for solutions of hyperbolic conservation laws is proposed: A weak solution is admissible if the total entropy decays with the highest possible rate. The equivalence of this criterion and viscosity criterion is established for the single equation and the system of equations of one dimensional nonlinear elasticity. Author (GRA)

N73-22262# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.

SECOND-HARMONIC RESONANCE IN THE INTERACTION OF CAPILLARY AND GRAVITY WAVES

Ali Hasan Nayfeh Dec. 1972 32 p refs (Contract N00014-72-A-0136-0002; NR Proj. 061-201) (AD-756218; VPI-E-72-26) Avail: NTIS CSCL 20/4

The method of multiple scales is used to derive equations governing the temporal and spatial variation for the amplitudes and phases of inviscid capillary-gravity traveling waves in the case of second harmonic resonance (Wilton's ripples), but including the effects of near resonance, liquid depth, and pressure perturbations exerted by an external subsonic gas on the liquid/gas interface. The spatial form of the equations shows that, below a critical gas velocity, energy is transferred between the fundamental and its first harmonic in keeping with the energy conservation law. However, the amplitude of the first harmonic decreases with gas velocity. Above the critical gas velocity, the gas/liquid interface grows monotonically with distance. It is found that pure amplitude-modulated waves are possible only at perfect resonance. Pure phase-modulated, near-resonant waves are periodic, as the resonance forces a readjustment of the phases to produce perfect resonance. The effectiveness of the resonance in rippling the interface increases as the liquid depth decreases. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-22263 Rice Univ., Houston, Tex.

DYNAMICS OF THE NEUTRAL ATMOSPHERE IN THE 200-500 km HEIGHT REGION AT LOW LATITUDES Ph.D. Thesis

Robert M. Harper 1972 176 p Avail: Univ. Microfilms Order No. 72-26418

Measurements of the meridional component of the neutral wind in the 200-500 km height interval at Arecibo by the incoherent scatter technique are presented and discussed. The daytime winds are poleward, with the maximum velocities occurring in the morning. It is shown that the north-south component of the neutral pressure gradient maximizes in the afternoon, in general agreement with models based on satellite drag density measurements. A reversal of the east-west electric field near 1400 hrs. causes driven ion motions to oppose the pressure gradient in the afternoon, resulting in small poleward winds at that time. Large equatorward winds observed to occur in the 2000-2400 hr. sector at night. The wind is observed to decrease and become poleward shortly after midnight. This behavior cannot be explained by the density variations contained in model atmospheres based on satellite drag results. A meridional wind model is presented for the American sector based on the observed winds at Arecibo and St. Santin, an

inferred electric field variation within the plasmasphere, and the ionogram data. Dissert. Abstr.

N73-22264 California Univ., San Diego.
SOME PROBLEMS IN SOLAR TERRESTRIAL PHYSICS Ph.D. Thesis
Christopher Thomas Gregory 1972 180 p
Avail: Univ. Microfilms Order No. 72-24631

The problem of a Prandtl-Meyer expansion of a gas allowing for the presence of electromagnetic fields and non-conducting walls is investigated. In the absence of electric fields it is found that solutions to the equations of motion may be discovered up to quadratures. In the more general case numerical techniques are used to solve the equations. Consideration is made of the loss of energetic protons and helium ions from the magnetosphere resulting from charge exchange collisions with neutral geocoronal hydrogen atoms and pitch angle scattering of ions into the atmospheric loss cone. Pitch angle distribution functions for protons and helium ions are found. Computation is made of the flux of positrons, 0.51 Mev annihilation gamma-rays, and energetic neutrons at earth under the assumption that these are produced by nuclear interactions in the solar atmosphere. The results are compared with observations. Dissert. Abstr.

N73-22265 Arizona Univ., Tucson.
COMPILATION AND PRELIMINARY INTERPRETATION OF THE ARIZONA AEROMAGNETIC MAP Ph.D. Thesis
William August Sauck 1972 161 p
Avail: Univ. Microfilms Order No. 72-25508

The aeromagnetic survey of Arizona was conducted during the summer of 1968, using a Cessna 180 aircraft and a digitally recording Elsec-Wisconsin proton procession magnetometer. Survey altitudes were 9,000 feet (2,740 meters) over most of Arizona and 11,000 feet (3,355 meters) in eastern Arizona. The line spacing was nominally 3 miles (5 km). The magnetic data, on punched paper tape, were collated with positioning information and transcribed to magnetic tape. Flight lines, with the contour crossing marked and labeled, were plotted on a map projection with a computer-driven incremental plotter. The contouring of the total magnetic intensity map was done manually.
Dissert. Abstr.

N73-22266 Houston Univ., Tex.
HYBRID COMPUTER SIMULATION OF TURBULENT DIFFUSION IN THE ATMOSPHERE BY MONTE CARLO METHOD Ph.D. Thesis
Jerry Allen Bullin 1972 197 p
Avail: Univ. Microfilms Order No. 72-27521

Turbulent diffusion in the atmosphere was simulated by implementing a Monte Carlo method on a hybrid computer. The method involved the development of a stochastic Langevin equation which required the instantaneous wind velocity as input information to simulate the diffusion process. Although several established models were available for the mean wind profile, there were no models available for the fluctuating component of the velocity. Thus a model was developed by using empirical equations to describe the rms value as a function of position and by using independent Gaussian white noises of proper frequency range and power spectral densities.
Dissert. Abstr.

N73-22267 Tennessee Univ., Knoxville.
REMOTE SENSING OF FALLOW SOIL MOISTURE USING VISIBLE AND INFRARED SENSORS Ph.D. Thesis
William Harold Allen 1972 109 p
Avail: Univ. Microfilms Order No. 72-27443

This study was designed to give a theoretical treatment of the cause-and-effect relationships between the physics of the soil and the resulting energy responses to be expected in the visible, near infrared, and thermal infrared wavelengths. Laboratory and field studies were performed to determine the feasibility of and the extent to which soil moisture levels of a fallow fine sandy loam Sequatchie soil could be detected and categorized using visible and near infrared photographic films and near and thermal infrared energy detectors as sensors. Color infrared film was exposed through four combinations of camera filters including Wratten No. 15 and 808 and Corning CS-1-59(3966). Other films used included infrared black-and-white and regular color film. Scanner detectors included the 2000- to 5000- nanometer range and the 8000- to 14000-nanometer range.
Dissert. Abstr.

N73-22268 Southern Methodist Univ., Dallas, Tex.
A STUDY OF THE EQUATORIAL F SUB 2 REGION IONOSPHERE Ph.D. Thesis
Donald Lowell Sterling 1972 160 p
Avail: Univ. Microfilms Order No. 72-27301

Many observed phenomena of the equatorial F-2 region ionosphere, such as: (1) the Appleton anomaly, (2) the noon biteout of ionization, (3) the splitting of the F-2 layer into two peaks during a magnetic storm or during a solar eclipse or (4) the presence of Fe(+) ions have appeared to be unrelated and therefore have not been well understood. These varied physical phenomena are correlated in terms of a single physical model. The assumptions used in constructing this method are based on known physical chemical processes which have been studied in other connections. We include in the model the processes involving photoionization, charge exchange, dissociative recombination, electromangetic drift, diffusion of ionization and neutral air winds. These processes are combined through a set of simultaneous equations involving the continuity equation and momentum transfer equation for electrons and for O(+), NO(+), O2(+), and N2(+) ions. Dissert. Abstr.

N73-22269 North Carolina Univ., Chapel Hill.
AN EXPERIMENTAL METHOD FOR MEASURING THE RATE OF SYNTHESIS, DESTRUCTION, AND TRANSPORT OF OZONE IN THE LOWER ATMOSPHERE Ph.D. Thesis
Harvey Edward Jeffries 1972 320 p
Avail: Univ. Microfilms Order No. 72-24806

A model for ozone behavior at a point in space was formulated. Each term of the model is discussed in detail and the individual factors affecting each term are identified. The four terms of the model can be measured (or computed) by the use of suitable ozone monitoring instruments and two gas phase continuous stirred tank reactors (CSTR) which provide direct measurements of the rates of chemical reactions. One CSTR was exposed to ambient sunlight and provided a measure of the rates of photochemical and thermal reactions; the other CSTR was dark and provided a measure of the rates of the thermal reactions only. A clear and dark, nonsteady-state CSTR system using chemiluminescent ozone monitoring instruments was operated at a semi-rural piedmont field station in North Carolina for 16 days in January and February of 1971. Eleven continuous days were selected for detailed analysis. The system performed satisfactorily, although suggestions for improvement were made.
Dissert. Abstr.

N73-22270 Boston Univ., Mass.
ANOMALIES AND IRREGULARITIES IN THE MID-LATITUDE IONOSPHERE Ph.D. Thesis
Henry Wendell Mullaney 1972 187 p
Avail: Univ. Microfilms Order No. 72-25311

The two major variations of the midlatitude nighttime F region from that predicted by basic ionospheric theory are the occurrence of irregularities in electron density, and the evening anomaly. These variations are examined theoretically and experimentally in order to determine their principal causes. The basic physical processes operating in the F region are outlined. Data cover processes neglected in the basic theory which contribute to evening anomalies, procedure for examining the anomaly, and fluctuations in the intensity of the 6300 A airglow line. Studies are included for scintillation indexes, total electron content, and total magnetic field intensity on twenty of the most disturbed scintillation days between November 1967 and March 1970. It was concluded that midlatitude scintillations are probably a manifestation of compressional waves, either internal gravity or horizontially ducted hydromagnetic waves, propagating through the midlatitude ionosphere. Dissert. Abstr.

N73-22271 Southern Methodist Univ., Dallas, Tex.
ARRAY STUDIES OF ATMOSPHERIC DISTURBANCES Ph.D. Thesis
John Andrew McDonald 1972 228 p
Avail: Univ. Microfilms Order No. 72-27292

A compendium of four separate but interrelated papers

concerning various forms of atmospheric disturbances is presented. The first paper deals with the near field shock effect related to the sonic boom developed by supersonic aircraft, and interaction of this shock with the terrain. The other three papers are studies in the far field of atmospheric disturbances; two being about small-scale turbulence effects and one about propagating waves in the atmosphere. A detailed abstract is given with each paper. Dissert. Abstr.

N73-22272 Iowa Univ., Iowa City.
OBSERVATIONS OF CHARGED PARTICLE PRECIPITATION OVER THE AURORAL ZONE DURING A MAGNETIC SUBSTORM Ph.D. Thesis
Kent Loy Ackerson 1972 69 p
Avail: Univ. Microfilms Order No. 72-26645

An array of sensitive electrostatic analyzers was launched on the satellite Injun 5 into a nearly polar, low-altitude orbit. A series of three traversals of the northern auroral zone in the local evening sector on 3 December 1968 has provided high energy and time resolution observations of low energy proton and electron intensities. The region of high intensities of plasma sheet electrons expanded dramatically during the substorm. Ring current protons with directional, integral intensities were injected to L approximates 4.5. It is concluded that the substorm was accompanied by a large-scale earthward motion and dissipation of the plasma sheet. Dissert. Abstr.

N73-22273 Iowa Univ., Iowa City.
TIME VARIATIONS OF MAGNETOSPHERIC INTENSITIES OF OUTER ZONE PROTONS, ALPHA PARTICLES AND IONS ($Z > 2$) Ph.D. Thesis
Bruce Aubrey Randall 1972 94 p
Avail: Univ. Microfilms Order No. 72-26726

A comprehensive study of the temporal behaviour of trapped protons, alpha particles, and ions in the outer zone of the earth's magnetosphere was made. These observations were made by the Injun 5 satellite during the first 21 months of operation, August 1968 to May 1970. Rapid increases in the observed number of particles followed by slower exponential decay characterize the data. Comparisons are made with the temporal behavior of interplanetary particles of the same energy observed by Explorer 35. Increases in the trapped fluxes generally correspond to enhanced interplanetary activity. The energy spectra of protons and alpha particles at $L = 3$ have similar shapes when compared on an energy per charge basis while the respective polar cap spectra have similar shape on an energy per nucleon basis. Apparent inward trans-L motion of energetic protons is observed. Dissert. Abstr.

N73-22274 Colorado Univ., Boulder.
GLOBAL SATELLITE ULTRAVIOLET SPECTROMETER MEASUREMENTS OF NITRIC OXIDE FLUORESCENCE WITH A DIFFUSIVE TRANSPORT MODEL FOR MESOSPHERIC, AND LOWER THERMOSPHERIC NITRIC OXIDE PHOTOCHEMISTRY Ph.D. Thesis
David William Rusch 1972 148 p
Avail: Univ. Microfilms Order No. 72-25214

Twilight measurements of fluorescence in the (1,0) gamma band of nitric oxide were made from June 1967 to January 1969 by an ultraviolet scanning spectrometer on board the polar orbiting satellite OGO-4. Nitric oxide vertical column emission rates were measured between solar zenith angles of 93 and 98 degrees. Seasonal and latitudinal variations were found to be less than a factor of 1.5, the scatter and uncertainty in the data prohibiting more precise determinations. Time-independent chemical-diffusion models for the vertical distribution of nitric oxide agree well with profiles measured from sounding rockets. The profiles have a minimum near 85 km of about a million nitric oxide molecules cu cm and a maximum at 105 km of about 10 million nitric oxide molecules cu cm. The column emission rates calculated from the theoretical models are larger than the satellite measurements by a factor of three.
Dissert. Abstr.

N73-22275*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY Progress Report, 23 Jun. 23 Dec. 1972
Duwayne M. Anderson, Harlan L. McKim, Richard K. Haugen, Lawrence W. Gatto, Charles W. Slaughter, and Thomas L. Marlar, Principal Investigators 23 Dec. 1972 50 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E73-10421; NASA-CR-131211) Avail: NTIS HC $4.50 CSCL 08L

There are no author-identified significant results in this report.

N73-22276*# Johns Hopkins Univ., Baltimore, Md. Maryland Geological Survey.
SURVEY OF GEOLOGY, MINERAL, AND WATER RESOURCES Progress Report
Kenneth N. Weaver, Principal Investigator 8 May 1973 6 p ERTS
(Contract NAS5-21848)
(E73-10433; NASA-CR-131223) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-22277*# General Electric Co., Philadelphia, Pa.
APPLICATION OF EARTH RESOURCES TECHNOLOGY SATELLITE DATA TO URBAN DEVELOPMENT AND REGIONAL PLANNING: TEST SITE, COUNTY OF LOS ANGELES Bimonthly Progress Report, Jan. - Feb. 1973
Surendra Raje, Principal Investigator, Richard Economy, Jene McKnight (Los Angeles County Regional Planning Comm.), and Phil Garofalo (Los Angeles County Regional Planning Comm.) 10 Mar. 1973 38 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21797)
(E73-10486; NASA-CR-131306; BMPR-2) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. Signigicant results have been obtained from the analyses of ERTS-1 imagery from five cycles over Test Site SR 124 by classical photointerpretation and by an interactive hybrid multispectral information extraction system (GEMS). Photointerpretation has produced over 25 overlays at 1:1,000,000 scale depicting regional relations and urban structure in terms of several hundred linear and areal features. A possible new fault lineament has been discovered on the northern slope of the Santa Monica mountains. GEMS analysis of the ERTS-1 products has provided new or improved information in the following planning data categories: urban vegetation; land cover segregation; manmade and natural impact monitoring; urban design; land suitability. ERTS-1 data analysis has allowed planners to establish trends that directly impact planning policies. For example, detectable grading and new construction sites quantitatively indicated the extent, direction, and rate of urban expansion which enable planners to forecast demand and growth patterns on a regional scale. This new source of information will not only assist current methods to be more efficient, but permits entirely new planning methodologies to be employed.

N73-22278*# TRW Systems, Redondo Beach, Calif.
EVALUATION OF DIGITAL CORRECTION OF TECHNIQUES FOR ERTS IMAGES Bimonthly Progress Report, Mar. - Apr. 1973
John E. Taber, Principal Investigator and S. S. Rifman Apr. 1973 3 p refs ERTS
(Contract NAS5-21814)
(E73-10503; NASA-CR-131541) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-22279*# Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.
WATER SURVEY OF CANADA: APPLICATION FOR USE OF ERTS-A FOR RETRANSMISSION OF WATER RESOURCES DATA Progress Report, Oct. 1972 - Mar. 1973
R. A. Halliday, Principal Investigator Apr. 1973 6 p Sponsored by NASA ERTS
(E73-10504; NASA-CR-131542) Avail: NTIS HC $3.00 CSCL

08H

The author has identified the following significant results. Over 7000 transmissions were received from six operating DCPs in 1972. Of these, only two were incorrect. One had the wrong date and the other had an invalid digit in the water level reading. Extensive checks have indicated that DCP data are accurate. The maximum number of transmissions received each day varies from 26 to 12 and the minimum from 10 to 3 depending on the site. Data has been received on as many as seven orbits in a day. The number of transmissions received from the two DCPs located in mountainous areas of southern B.C. is lower than the number received from more northerly but more open sites. The unheated DCPs have survived temperatures of -40 F and antenna loadings of two feet of snow and wind speeds over 50 mph. Two DCPs have indicated sensor malfunctions thus alerting field staff to the fact that repairs will be necessary on their next visit to the site. Also in another case, DCP data were used to fill in a period of missing record when a water level recorder malfunctioned for a few days.

N73-22280*# Mitre Corp., McLean, Va.
INVESTIGATION OF ENVIRONMENTAL INDICES FROM THE EARTH RESOURCES TECHNOLOGY SATELLITES Bimonthly Progress Report
Edward A. Ward, Principal Investigator and R. P. Ouellette 30 Apr. 1973 4 p ERTS
(Contract NAS5-21482)
(E73-10505; NASA-CR-131543; D22-1573) Avail: NTIS HC $3.00 CSCL 08D

The author has identified the following significant results. Correlation between the EPA/NOAA Atmospheric Turbidity Network data and the average greyness of ERTS-1 imagery over the same test site gives promise of a use for ERTS as a source of mesoscale turbidity information. Care however must be given to avoid weather front and urban effect anomalies.

N73-22281*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.
LAND USE IN NORTHERN MEGALOPOLIS Progress Report
Robert B. Simpson, Principal Investigator 4 May 1973 2 p ERTS
(Contract NAS5-21749)
(E73-10506; NASA-CR-131544; PR-6) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-22282*# American Univ., Washington, D.C.
ERTS-1 DATA USER INVESTIGATION OF WETLANDS ECOLOGY Progress Report
Richard R. Anderson, Principal Investigator 16 Apr. 1973 5 p ERTS
(Contract NAS5-21752)
(E73-10507; NASA-CR-131545; PR-5) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. ERTS-1 imagery (enlarged to 1:250,000) is an excellent tool by which large area coastal marshland mapping may be undertaken. If states can sacrifice some accuracy (amount unknown at this time) in placing of boundary lines, the technique may be used to do the following: (1) estimate extent of man's impact on marshes by ditching and lagooning and accelerated successional trends; (2) place boundaries between wetland and upland and hence estimate amount of coastal marshland remaining in the state; (3) distinguish among relatively large zones of various plant species including high and low growth S. alterniflora, J. roemerianus, and S. cynosuroides; and (4) estimate marsh plant species productivity when ground based information is available.

N73-22283*# Earth Satellite Corp., Berkeley, Calif.
ERTS DATA USER INVESTIGATION TO DEVELOP A MULTISTAGE FOREST SAMPLING INVENTORY SYSTEM Progress Report, Sep. 1972 - Feb. 1973
Philip G. Langley, J. W. VanRoessel, Principal Investigators, and S. L. Wert 28 Feb. 1973 23 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21853)
(E73-10508; NASA-CR-131546) Avail: NTIS HC $3.25 CSCL 02F

The author has identified the following significant results. A system to provide precision annotation of predetermined forest inventory sampling units on the ERTS-1 MSS images was developed. In addition, an annotation system for high altitude U2 photographs was completed. MSS bulk image accuracy is good enough to allow the use of one square mile sampling units. IMANCO image analyzer interpretation work for small scale images demonstrated the need for much additional analysis. Continuing image interpretation work for the next reporting period is concentrated on manual image interpretation work as well as digital interpretation system development using the computer compatible tapes.

N73-22284*# Alabama Univ., University.
INVESTIGATIONS USING DATA IN ALABAMA Bimonthly Progress Report, 7 Dec. 1972 - 9 Feb. 1973
Harold R. Henry, Principal Investigator 9 Feb. 1973 31 p ERTS
(Contract NAS5-21876)
(E73-10509; NASA-CR-131469; BMPR-2) Avail: NTIS HC $3.75 CSCL 08F

There are no author-identified significant results in this report.

N73-22285*# Utah Univ., Salt Lake City. Dept. of Geological and Geophysical Sciences.
MINERAL EXPLORATION AND FRACTURE TRENDS IN UTAH AND NEVADA, BY ERTS-1 IMAGERY Progress Report
Mead L. Jensen, Principal Investigator and M. Smith 24 Apr. 1973 7 p ERTS
(Contract NAS5-21883)
(E73-10510; NASA-CR-131620) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Major structural trends have been compiled on five separate maps, at a scale of 1:1,000,000, of Utah and Nevada from ERTS-1 imagery. An arbitrary length of ten kilometers has been chosen as a minimum length of the trends. The selection is based upon: (1) obvious displacement of structures; (2) continuity or persistence of trends across structures; (3) line-up of outcrop patterns, drainage, erosional features or vegetation; and (4) near-linear trends. Several recognizable trend directions were noted, viz., N 10-15 deg W, N 35 deg W, N 80 deg W, N 30 deg E, and E-W. More than 1500 structural trends have been identified, some of which are mineralized and extend into pediment or shallow alluvial cover. Those fracture trends that exhibit mineralization in exposed bedrock will be assayed for mercury content with a soil-gas analyzer, and similar collection will be done over alluvial posture blankets by the same technique with the hope of discovering blind mineralized zones that are not exposed on the surface.

N73-22286*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY Bimonthly Progress Report
Duwayne M. Anderson, H. L. McKim, R. K. Haugen, L. W. Gatto, C. W. Slaughter, and T. L. Marlar, Principal Investigators 23 Apr. 1973 51 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70253-AG)
(E73-10511; NASA-CR-131621; BMPR-4) Avail: NTIS HC $4.75 CSCL 08L

There are no author-identified significant results in this report.

N73-22287*# Idaho Univ., Moscow. Coll. of Forestry, Wildlife, and Range Sciences.
APPLICATION OF REMOTE SENSING IN THE STUDY OF VEGETATION AND SOILS IN IDAHO Interim Report, Nov. 1972 - May 1973
E. W. Tisdale, Principal Investigator May 1973 20 p ERTS
(Contract NAS5-21850)
(E73-10512; NASA-CR-131470) Avail: NTIS HC $3.00 CSCL 08M

The author has identified the following significant results. Comparison of ERTS-1 imagery and USGS 1:250,000 scale maps of study areas with known ground points revealed significant map errors. These errors were sufficient to render impractical

the projection of ERTS-1 imagery directly onto maps of the area. Marked differences were found in the delineation of ground features by different MSS bands. Generally, Band 4 was least useful, while Band 5 proved valuable for indicating patterns of native vegetation, cultivated areas (both dry and irrigated), lava fields, drainage basins, and deep bodies of water. Band 6 was better for landforms and drainages and for shallow bodies of water than Band 5 but inferior for indicating patterns in native vegetation and most types of cultivated land. Band 7 was best of all for indicating lava flows, water bodies, and landform features. Use of an additive color viewer-projector aided greatly in separation of images. A combination of Bands 5 and 7 with appropriate color filters proved best for separating most types of native vegetation and cultivated crops. Landform features and water bodies also showed well with this combination. The addition of Band 4 imagery to these further enhanced the identification of semi-dormant vegetation.

N73-22288*# Department of Agriculture, Washington, D.C.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Feb. - 19 Apr. 1973
Donald H. VonSteen, Principal Investigator 19 Apr. 1973 5 p ERTS
(NASA Order S-70251; AG-3)
(E73-10514; NASA-CR-131472) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-22289*# Arizona Univ., Tucson.
EVALUATION OF ERTS-1 IMAGE SENSOR SPATIAL RESOLUTION IN PHOTOGRAPHIC FORM Progress Report
P. N. Slater, Principal Investigator and R. A. Schowengerdt May 1973 6 p ERTS
(Contract NAS5-21849)
(E73-10521; NASA-CR-131488; PR-4) Avail: NTIS HC $3.00 CSCL 14E

There are no author-identified significant results in this report.

N73-22290*# Maine Dept. of Transportation, Augusta.
DETECTION AND MONITORING VEGETATION DAMAGE ASSOCIATED WITH HIGHWAY FACILITIES Progress Report
E. G. Stoeckeller, Principal Investigator 1 May 1973 2 p ERTS (Contract NAS5-21724)
(E73-10522; NASA-CR-131489; PR-6) Avail: NTIS HC #3.00 CSCL 02B

There are no author-identified significant results in this report.

N73-22291*# Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM ERTS-1 DATA Progress Report, 7 Mar. 1972 - 6 May 1973
M. Griggs, Principal Investigator 7 May 1973 11 p ERTS (Contract NAS5-21860)
(E73-10524; NASA-CR-131491; SAI-73-537-LJ; PR-4) Avail: NTIS CSCL 04B

There are no author-identified significant results in this report.

N73-22292*# Army Engineer Command, Vietnam, APO San Francisco, Calif. 96491
CALIFORNIA COAST NEARSHORE PROCESSES STUDY Progress Report, 1 Mar. - 30 Apr. 1973
Douglas M. Pirie, Principal Investigator and David D. Steller (Rockwell Intern. Corp., Downey, Calif.) May 1973 7 p ERTS (NASA Order S-70257-AG)
(E73-10525; NASA-CR-131492; ERTS-1-I-3) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Remote sensor aircraft flights took place simultaneously with ERTS-1 overpasses at the San Francisco, Monterey Bay, and Santa Barbara test cells. The cameras and scanners used were configured for detecting suspended sediment and for maximum water penetration. The Ektachrome/Wratten 12 photographs which were intentionally overexposed 1-1/2 stops were found to show the most extensive sediment transport detail. Minus blue/K 2 photographs illustrate nearshore underwater bottom detail including the head of the Mugu submarine canyon. The EMSIDE 9 channel scanner was employed to classify and differentiate suspended sediment, oil, kelp, and other materials found in the nearshore area. Processing of bulk ERTS-1 computer compatible tapes was utilized to enhance and analyze nearshore sediments. This technique was most successful in enhancing subtle nearshore features found to be faint or invisible on prints made from the supplied negatives. In addition to this continuing computer process, an effort was initiated to interface density values from the bulk tapes into contouring and mapping software.

N73-22293*# Kennecott Exploration, Inc., Salt Lake City, Utah. Exploration Services Dept.
RECOGNITION OF THE GEOLOGIC FRAMEWORK OF PORPHYRY COPPER DEPOSITS ON ERTS-1 IMAGERY Progress Report
John C. Wilson, Principal Investigator 8 May 1973 3 p ERTS (Contract NAS5-21769)
(E73-10526; NASA-CR-131499) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-22294*# Earth Satellite Corp., Berkeley, Calif.
INVESTIGATION TO DEVELOP A MULTISTAGE FOREST SAMPLING INVENTORY SYSTEM USING ERTS-1 IMAGERY Progress Report, Mar. - Apr. 1973
Philip G. Langley, Principal Investigator Apr. 1973 3 p refs ERTS
(Contract NAS5-21853)
(E73-10528; NASA-CR-131567) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-22295*# Research Triangle Inst., Durham, N.C.
CORRELATION OF OCEAN SURFACE PARAMETERS WITH RADAR BACKSCATTERING DATA AND THEORY Monthly Progress Report, 8-31 Mar. 1973
Lee S. Miller and Gary S. Brown, Principal Investigators 19 Apr. 1973 2 p EREP
(Contract NAS9-13304)
(E73-10530; NASA-CR-131595) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N73-22296*# Earth Satellite Corp., Berkeley, Calif.
EVALUATION OF USEFULNESS OF SKYLAB EREP S-190 AND S-192 IMAGERY IN MULTISTAGE FOREST SURVEYS Monthly Progress Report, 28 Feb. 1973 - 31 Mar. 1973
Philip G. Langley, Principal Investigator 31 Mar. 1973 3 p EREP
(Contract NAS9-13289)
(E73-10531; NASA-CR-131596) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. To transfer points from topographic maps to space platform imagery a generalized resection program has been developed in which any resection parameter can be enforced in the solution to any desired extent. This allows for the use of orbital parameters in the resection solution. In addition to the resection program, a technique has been developed applicable to space platform photography with which elevations can be assigned to digitized map points through the use of digital terrain models. Using this technique tedious manual elevation assignment for thousands of digitized points can be avoided. The software to project the map points to the space platform image has also been developed and tested. Programs are being tested to relate the projected image coordinates to digital image tape locations so that any desired sample unit can be retrieved from the digital tapes with considerable accuracy.

N73-22297*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report
Roger M. Hoffer, Principal Investigator Apr. 1973 3 p EREP
(Contract NAS9-13380)
(E73-10533; NASA-CR-131598) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-22298*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.
APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Progress Report, 1 Mar. - 30 Apr. 1973
Harvey K. Nelson, Principal Investigator 1 May 1973 3 p ERTS
(NASA Order S-70243-AG-4)
(E73-10534; NASA-CR-131610) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-22299*# Geological Survey, Washington, D.C.
GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 15 Jan. - 30 Apr. 1973
Richard S. Williams, Jr., Principal Investigator 1 May 1973 8 p refs Sponsored by NASA ERTS
(E73-10535; NASA-CR-131611) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. A binational, multidisciplinary research effort in Iceland is directed at an analysis of MSS imagery from ERTS-1 to study a variety of geologic, hydrologic, oceanographic, and agricultural phenomena. Initial findings are: (1) recent lava flows can be delineated from older ones; (2) ERTS-1 and NOAA-2 recorded volcanic eruptions on Heimaey, Vestmann Islands; (3) coastline changes are mappable; (4) areas covered with new or residual snow can be mapped, and dark appearance of newly fallen snow on band 7 appears to be related to melting; (5) sediment plumes from discharge of glacial rivers can be delineated; (6) the area encompassed by glacial ice can be mapped, including the new position of a surging glacier, Eyjabakkajokull, and related phenomena of nunataks and moraines; (7) changes in position of rivers, lake sizes, and new lakes can be mapped; (8) low sun angle imagery enhances the morphologic expression of constructional glacial and volcanic landforms; (9) MSS color composites permit regional mapping of distribution of vegetation; and (10) at least at 1:250,000 map scale and smaller, ERTS-1 imagery provides a means of updating various types of maps of Iceland and will permit the compilation of maps specifically aimed at those dynamic environmental phenomena which impact on the Icelandic economy.

N73-22300*# Geological Survey, McLean, Va. Topographic Div.
MAN MADE CULTURE INTERPRETATION AND CULTURE REVISION OF SMALL SCALE MAPS Progress Report, 1 Jan. - 31 Mar. 1973
William J. Kosco, Principal Investigator 31 Mar. 1973 3 p ERTS
(NASA Order S-70243-AG)
(E73-10536; NASA-CR-131612) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. A major interstate highway added to the Wilmington, Del., quadrangle by another revision method was determined by the ERTS-1 data to have been misplotted from its true position. In addition to the experiment, where ERTS-1 data is available and small-scale revision is in progress, the ERTS-1 data is routinely being used to make additions and deletions of hydrographic features.

N73-22301*# Bureau of Reclamation, Denver, Colo.
APPLICATION OF REMOTE SENSING TO SELECTED BUREAU OF RECLAMATION PROJECTS Progress Report, 1 Mar. - 30 Apr. 1973
Larry D. Cast, Principal Investigator 1 May 1973 2 p ERTS
(NASA Order S-70243-AG)
(E73-10537; NASA-CR-131613) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-22302*# Geological Survey, Washington, D.C.
CENSUS CITIES EXPERIMENT IN URBAN CHANGE DETECTION Progress Report, 1 Mar. - 30 Apr. 1973
James R. Wray, Principal Investigator 1 May 1973 6 p ERTS
(NASA Order S-70243-AG-2)
(E73-10538; NASA-CR-131614) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-22303*# Geological Survey, Washington, D.C.
THE UTILIZATION OF ERTS-1 GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Mar. - 30 Apr. 1973
Daniel B. Krinsley, Principal Investigator 1 May 1973 3 p refs ERTS
(NASA Order S-70243-AG-3)
(E73-10539; NASA-CR-131615) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-22304*# Geological Survey, Washington, D.C.
ANALYSIS STUDY OF MULTISPECTRAL DATA, ERTS-A, FROM AN AREA IN WEST PAKISTAN Ph.D. Thesis
Robert G. Schmidt, Principal Investigator 1 May 1973 2 p ERTS
(NASA Order S-70243-AG)
(E73-10540; NASA-CR-131616) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-22305*# Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE, AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA, AND AUSTRALIA Progress Report, 1 Mar. - 31 Apr. 1973
Edwin D. McKee, Principal Investigator 1 May 1973 28 p ERTS
(NASA Order S-70243-AG-4)
(E73-10542; NASA-CR-131618) Avail: NTIS HC $3.50 CSCL 08M

There are no author-identified significant results in this report.

N73-22306*# Geological Survey, Tucson, Ariz.
DYNAMICS OF DISTRIBUTION AND DENSITY OF PHREATOPHYTES AND OTHER ARID LAND PLANT COMMUNITIES Progress Report, 1 Jan. - 28 Feb. 1973
Raymond M. Turner, Principal Investigator 1 Apr. 1973 2 p ERTS
(NASA Order S-70243-AG-2)
(E73-10543; NASA-CR-131619) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-22307*# Ecole Practique des Hautes Etudes, Paris (France).
MARSHES AND TURBID WATERS IN THE FRENCH ATLANTIC LITTORAL Progress Report, Mar. - Apr. 1973
Fernand Verger, Principal Investigator May 1973 4 p Sponsored by NASA ERTS
(E73-10548; NASA-CR-131652) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-22308# Martin Marietta Corp., Denver, Colo.
MINERAL RESOURCES LOCATED BY REMOTE SENSING: LIMESTONE, COPPER, MOLYBDENUM
Mar. 1973 56 p Original contains color illustrations
(MCR-73-62) Avail: NTIS HC $5.00

The application of remote sensing technology to commercial mining activities is discussed. Both investigations were in the field of mineral exploration, but were conducted under greatly different conditions of vegetation cover, requiring two different technological approaches. The prime technique was the description and analysis of surface morphology to include topography, drainage, surface geology, soils, gravels, and vegetation. Analysis of the remotely sensed data was confirmed by drilling, geochemistry, and ore grade mineralization. Author

N73-22309*# Stanford Univ., Calif. Radioscience Lab.
TWO SUBSTORM STUDIES OF RELATIONS BETWEEN WESTWARD ELECTRIC FIELDS IN THE OUTER PLASMASPHERE, AURORAL ACTIVITY, AND GEOMAGNETIC PERTURBATIONS

D. L. Carpenter and Syun-I. Akasofu (Alaska Univ., College) [1972] 20 p refs
(Grants NGL-05-020-008; NSF GA-32590X; NSF GA-18128; NSF GV-28840X; NSF GA-12317; NSF GP-948; NSF GA-28101)
(NASA-CR-131497) Avail: NTIS HC $3.00 CSCL 04A

Temporal variations of the westward component of the magnetospheric convection electric field in the outer plasmasphere were compared to auroral activity near L = 7, and to variations in the geomagnetic field at middle and high latitudes. The substorms occurred on July 29, 1965 near 0530 UT and on August 20, 1965 near 0730 UT. The results on westward electric field E(w) were obtained by the whistler method using data from Eights, Antarctica (L is approximately 4). All sky camera records were obtained from Byrd, Antarctica, (L is approximately 7), located within about 1 hour of Eights in magnetic local time. It was found that E(w) within the outer plasmasphere increased rapidly to substorm levels about the time of auroral expansion at nearby longitudes. This behavior is shown to differ from results on E(w) from balloons, which show E(w) reaching enhanced levels prior to the expansion. A close temporal relation was found between the rapid, substorm associated increases in E(w) and a well known type of nightside geomagnetic perturbation. Particularly well defined was the correlation of E(w) rise and a large deviation of the D component at middle latitudes. Author

N73-22310*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
ARE HO RADICALS PRODUCED IN THE REACTION OF O(3P) WITH 1-C4H8 ?
Menachem Luria, R. Simonaitis, and Julian Heicklen 1 Sep. 1972 10 p refs
(Grants NGL-39-009-003; NSF GA-12385)
(NASA-CR-131590; PSU-IRL-SCI-409) Avail: NTIS HC $3.00 CSCL 04A

The reaction of O(3P) with 1-C4H8 was examined in the presence of CO which scavenges HO radicals to produce CO2. From the CO2 quantum yield, an upper limit to the efficiency of HO production in the reaction of O(3P) with 1-C4H8 was found to be 0.020 at both 298 and 473 K. Author

N73-22311*# Alaska Univ., College. Geophysical Inst.
SPECTROPHOTOMETRY OF PLANETARY ATMOSPHERE FROM THE X-15 ROCKET AIRPLANE Final Report
Wallace B. Murcray 20 Mar. 1973 5 p refs
(Grant NGR-02-001-027)
(NASA-CR-131484) Avail: NTIS HC $3.00 CSCL 04A

Nike-Apache and Nike-Tomahawk rocket flights using spectrophotometric techniques to investigate auroral activity are reported. The specific objectives were to obtain data relative to typical auroral situations, including quiet pre-breakup auroras, westward traveling surges, breakup auroras, and post-breakup auroras. It was found that excited atoms move considerable distances between excitation and emission owing to the high velocity wind conditions prevailing above 200 km. Based on the results of these observations, recommendations are made for future studies of ionized atmospheric activity at higher altitudes. J.M.M.

N73-22312*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE REACTIONS OF HO2 WITH CO AND NO AND THE REACTION OF O(1D) WITH H2O
R. Simonaitis and Julian Heicklen 8 Feb. 1973 37 p refs
(Grant NGL-39-009-003; NSF GA-12385)
(NASA-CR-131603; PSU-IRL-SCI-413) Avail: NTIS HC $4.00 CSCL 04A

HO2 radicals were generated by the photolysis of N2O at 2139 A in the presence of excess H2O or H2 and smaller amounts of CO and O2. The O(1D) atoms produced from the photolysis of N2O to give HO radicals or H2 to give HO + H. With H2O two HO radicals are produced for each O(1D) removed low pressures (i.e. approximately 20 torr H2O), but the HO yield drops as the pressure is raised. This drop is attributed to the insertion reaction: O(1D) + H2O + M yields H2O2 +M. The HO radicals generated can react with either CO or H2 to produce H atoms which then add to O2 to produce HO2. Two reactions are given for the reactions of the HO radicals, in the absence of NO. Author

N73-22313*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
RELATIONS AMONG LOW IONOSPHERE PARAMETERS AND HIGH FREQUENCY RADIO WAVE ABSORPTION
John P. Cipriano 9 Jan. 1973 76 p refs
(Grants NGR-39-009-218; DA-ARO(D)-31-124-72-G158)
(NASA-CR-131604; PSU-IRL-SCI-410) Avail: NTIS HC $6.00 CSCL 04A

Charged particle conductivities measured in the very low ionosphere at White Sands Missile Range, New Mexico, and Wallops Island, Virginia, are compared with atmospheric parameters and high frequency radio wave absorption measurements. Charged particle densities are derived from the conductivity data. Between 33 and 58 km, positive conductivity correlated well with neutral atmospheric temperature, with temperature coefficients as large as 4.6%/deg K. Good correlations were also found between HF radio wave absorption and negative conductivity at altitudes as low as 53 km, indicating that the day-to-day absorption variations were principally due to variations in electron loss rate. Author

N73-22314*# National Aeronautics and Space Administration, Washington, D.C.
IONOSPHERE DISTURBANCES AND THEIR INFLUENCE ON RADIO COMMUNICATIONS
R. A. Zevakina, ed. and L. N. Lyakhova, ed. Apr. 1973 328 p refs Transl. into ENGLISH of the book "Ionosfernyye Vozmushcheniya i ikh Vliyaniye na Radiosvyaz" Moscow, Nauka Press, 1971 p 1-234
(NASA-TT-F-746) Avail: NTIS HC $6.00 CSCL 20N

A collection of articles is presented, reporting the results of studies in field of ionospheric disturbances, and on techniques for improving the prediction of disturbances. Studies are included on the patterns of ionospheric disturbance, onset and behavior in the high, middle, and equatorial latitudes, the statistical characteristics of the ionospheric disturbance, and the variation of the ionization altitude distribution under disturbed conditions. For individual titles, see N73-22315 through N73-22331.

N73-22315* National Aeronautics and Space Administration, Washington, D.C.
IONOSPHERIC DISTURBANCES **c07**
R. A. Zevakina *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 1-33 refs (For availability see N73-22314 13-13)
CSCL 17B

The principles governing ionospheric disturbances are described as the basis for predicting such disturbances. Sudden ionospheric disturbances, polar cap absorption, auroral absorption, and disturbances of the F-2 region are examined. Author

N73-22316* National Aeronautics and Space Administration, Washington, D.C.
CONNECTION BETWEEN IONOSPHERIC DISTURBANCE AND PARAMETERS OF THE INTERPLANETARY MEDIUM
V. P. Kuleshova *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 34-40 refs (For availability see N73-22314 13-13)
CSCL 04A

A correlation was made between ionospheric disturbance and the velocity, density, and flux of interplanetary medium positive ions (from the data of the Mariner-2, Venus-3, and Vela-2 vehicles). An increase of the interplanetary medium proton velocity was noted in the magnetoionospheric disturbance period. At the high-latitude stations there is a considerable increase or decrease of f sub 0 F-2 after high values of the interplanetary medium positive ion fluxes. At the mid-latitudes, the ionosphere does not experience marked changes at this time. High values of the interplanetary medium proton density are characteristic of the quiet magnetospheric periods. Author

N73-22317* National Aeronautics and Space Administration, Washington, D.C.
GEOPHYSICAL EFFECTS OF THE X/28/1963 PROTON FLARE **c29**

G. N. Pushkova *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 41-46 refs (For availability see N73-22314 13-13)
CSCL 03B

The geophysical effects caused by the proton burst on X/28/1963 at 0135 UT are examined. The ionospheric disturbance is also analyzed. The change of the critical frequencies during the disturbance was examined for the world network of stations. The change of the electron concentration with altitude is presented. The changes in time of the true height disturbance are examined from the data of vertical atmosphere sounding at the Moscow station. The SC effect is analyzed. Author

N73-22318* National Aeronautics and Space Administration, Washington, D.C.
ANOMALOUS F-REGION IONIZATION IN THE HIGH-LATITUDE DARK IONOSPHERE
Ye. Ye. Goncharova and L. A. Yudovich *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 47-73 refs (For availability see N73-22314 13-13)
CSCL 04A

The anomalous ionization patterns, during the winter months, on the solar activity rise and fall branches are examined from the vertical sounding data at high-altitude stations in the Northern and Southern Hemispheres. It is found that upon reduction of the solar activity there is a shift of the moments of occurrence of the maximum anomalous ionization values toward earlier hours of local time and poleward displacement of the equatorial border of the region of anomalous ionization appearance. An oval shape of the anomalous ionization frequency isolines is maintained in all years of the solar cycle. In the anomalous ionization periods there is a marked change of the geometric parameters of the F layer and ionization at levels located above 180 to 200 km. In the maximum activity period the ion formation rate increases by 4 to 5 times in comparison with the period of minimum activity. Author

N73-22319* National Aeronautics and Space Administration, Washington, D.C.
DEVIATION OF F-REGION CRITICAL FREQUENCIES FROM MEDIAN VALUES
T. V. Gayvoronskaya, N. P. Sergeyenko, and L. A. Yudovich *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 74-97 refs (For availability see N73-22314 13-13)
CSCL 04A

The statistical distribution of the F-2 layer critical frequency deviations from the sliding median is examined as a function of solar activity cycle phase, latitude, season, and time of day. The differential distributions are used to calculate the probabilities of fixed deviations as a function of geometric latitude for daytime and nighttime hours, which can then be used to evaluate the reliability of planned radio communication. Author

N73-22320* National Aeronautics and Space Administration, Washington, D.C.
PREDICTING F2-REGION CRITICAL FREQUENCIES
M. V. Kiseleva, M. P. Kiyanovskiy, V. S. Knyazyuk, L. N. Lyakhova, and L. A. Yudovich *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 98-131 refs (For availability see N73-22314 13-13)
CSCL 04A

The time and space correlations between the F2-layer critical frequency deviations from the normal values are examined on the basis of ionospheric data for maximum (1958) and minimum (1964) solar activity years. The results for the time correlation amount to the following: 1) for the middle latitudes, the temporal stability is highest on negatively disturbed days and lowest on positively disturbed days; 2) the stability is higher in the summer than in the winter; 3) the stability is somewhat greater in the daytime than at night; 4) on the average, the stability is greater in a maximum activity year than in a minimum activity year. The space correlation study confirmed the marked decrease of the correlation coefficient with distance in longitude and, particularly, in latitude. The space correlation is somewhat higher at the time of negative disturbances and in years of maximum solar activity; it is higher in the daytime than at night. Author

N73-22321* National Aeronautics and Space Administration, Washington, D.C.
PREDICTING THE GEOMETRIC PARAMETERS OF THE N(h) PROFILES AND h PRIME f CHARACTERISTICS OF THE QUIET AND DISTURBED IONOSPHERE. 1: REGULAR VARIATIONS OF THE N(h) AND h PRIME f GEOMETRIC PARAMETERS
B. S. Shapiro, T. A. Anufriyeva, A. A. Freyzon, and T. L. Vinnikova *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 132-154 refs (For availability see N73-22314 13-13)
CSCL 04A

Results are presented of a further improvement of the technique and new data for predicting the N(h) profiles and the h prime f characteristics of the quiet F region. Generalized maps are presented for predicting the planetary distribution of h sub max and y sub m of the F-2 layer for the index W > 100. These maps, together with those obtained earlier for W < or = to 100, make it possible to predict N(h) and h prime f for any number W and at any point above the earth's surface. The questions of compiling and using the published N(h) and h prime f predictions are discussed. Author

N73-22322* National Aeronautics and Space Administration, Washington, D.C.
PREDICTING THE GEOMETRIC PARAMETERS OF THE N(h) PROFILES AND h PRIME f CHARACTERISTICS OF THE QUIET AND DISTURBED IONOSPHERE. 2: VARIATIONS OF THE N(h) AND h PRIME f PARAMETERS FROM DAY TO DAY
N. I. Potapova *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 155-179 refs (For availability see N73-22314 13-13)
CSCL 04A

The daily variation of the magnitude of the mean-square critical F-2 frequency deviation from the monthly mean value at stations of various latitude zones during periods with different solar activity is examined. The characteristics are noted of the magnitudes of the geometric parameter fluctuations in regions where the critical frequency variations increased markedly from day to day, in the region of equatorial anomaly latitudinal maximum, and in the subtropical region. The variability of the effective reflection altitudes owing to the variations of f sub O F-2 from day to day at the different latitudes is evaluated. The influence of F-2 layer critical frequency on the determination of the disturbed conditions is discussed. The problems in predicting the variability of the critical frequencies and effective radiowave reflection heights and the function of f sub O F-2 variability are examined. Author

N73-22323* National Aeronautics and Space Administration, Washington, D.C.
PREDICTING THE N(h) PROFILES AND h PRIME f CHARACTERISTICS OF THE QUIET AND DISTURBED F REGION. 3: N(h) AND h PRIME f PARAMETERS DURING DISTURBANCES
B. S. Shapiro and V. M. Shashunkina *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 180-197 refs (For availability see N73-22314 13-13)
CSCL 04A

The basic relations governing the N(h) and h prime f deviations from the norm during a magnetoionospheric storm as a function of the magnetic and ionospheric disturbance index and the initial conditions in the ionosphere (time of day, season, latitude, and solar activity level) are discussed. The technique is described for formulating the published experimental long-term predictions of deviations from the monthly average values of the parameters N(h) and h prime f during the disturbance main phase and in the ionospheric SC effect period. The method of predicting the ionospheric and magnetic disturbance indices for which these deviations can be expected is also described. The possibility of short-term improvement of the N(h) and h prime f predictions for the disturbed F-layer is discussed. Author

N73-22324* National Aeronautics and Space Administration, Washington, D.C.
PREDICTING THE N(h) PROFILES AND h PRIME f CHARACTERISTICS OF THE QUIET AND DISTURBED IONOSPHERE. 4: VARIATIONS OF ARRIVAL ANGLES

DELTA AND SKIP DISTANCES D

B. S. Shapiro, N. I. Potapova, T. A. Anufriyeva, I. A. Freyzon, and V. M. Shashunkina *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 198-223 refs (For availability see N73-22314 13-13)

CSCL 04A

The questions of predicting the arrival angle (Delta) and skip distance (D) variations on the basis of the monthly predictions of the N(h) profiles and h prime f characteristics are discussed. Maps are presented for predicting the minimum effective height and height of reflection for a wave with frequency close to the MUF. These maps are used to determine the values of the departure angles. Data are presented on the Delta and D fluctuations from day to day at different latitudes for different solar activity. The influence of different N(h) and h prime f parameters on the Delta and D variations is analyzed. The possibilities of using current observational information to reduce the errors which arise when determining Delta and D on the basis of the prediction of the monthly mean values of the N(h) and h prime f parameters on quiet days are discussed. The errors in determining Delta and D during disturbances from the prediction of the quiet ionosphere parameters are examined along with the technique for their reduction using the N(h) and h prime f prediction for the disturbed F-layer. Author

N73-22325* National Aeronautics and Space Administration, Washington, D.C.

LONG-TERM PROGNOSIS OF MIDDAY N(h) PROFILES

N. I. Timchenko *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 224-230 refs (For availability see N73-22314 13-13)

CSCL 04A

Calculation of the N(h) profiles using the data of observations at Tomsk at the midday hours for several years made it possible to establish the existence of a definite annual variation of N at all levels of the F-region. The altitude dependence of N at the midday hours was studied for several solar activity levels. A method is proposed for predicting the electron concentration altitude distribution for the midday hours. Author

N73-22326* National Aeronautics and Space Administration, Washington, D.C.

CALCULATION OF RADIOWAVE ABSORPTION AND FIELD INTENSITY FOR OBLIQUE INCIDENCE ON THE IONOSPHERE BASED ON VERTICAL SOUNDING DATA c07

Yu. R. Pushkin and M. D. Fligel *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 231-249 refs (For availability see N73-22314 13-13)

CSCL 20N

A graphical method is proposed for calculating the field intensity, LUF, and minimum required power with account for antenna parameters at distances for which the ionosphere can be considered constant along the path. The method is based on data from vertical sounding of the ionosphere (nomograms and absorption measurement by the pulse method). This method takes into account directly multipath transmission in calculating the field intensity, which makes it possible to select the radiowave propagation mode which is most effective for each specific case. A method is proposed for quantitative estimation of the absorption (and also the field intensity and required transmitter power) along the radio path during disturbances from cosmic radio emission absorption measurement (riometer) data. Author

N73-22327* National Aeronautics and Space Administration, Washington, D.C.

THE INFLUENCE OF IONOSPHERIC AND MAGNETIC DISTURBANCES ON SHORT-WAVE RADIO COMMUNICATIONS c07

R. A. Zevakina, M. V. Kiseleva, G. N. Pushkova, and V. A. Chernova *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 250-260 refs (For availability see N73-22314 13-13)

CSCL 17B

The change of signal intensity is examined as a function of F2-region disturbances and magnetic activity from recordings of the Moscow transmitter at Murmansk, Magadan, and Irkutsk. The transmitter operated around the clock at definite periods using directional antennas at 10 fixed frequencies from 1.5 to 24 MHz. It is shown that under quiet and disturbed conditions the highest signal intensities are observed at frequencies 10 to 30% below the MUF. During disturbances the signal intensity decreases at all points, and most markedly when magnetic and ionospheric disturbances are observed simultaneously. Communications are disrupted in the case of large reduction of foF2 accompanied by high magnetic activity. Author

N73-22328* National Aeronautics and Space Administration, Washington, D.C.

LAWS GOVERNING F-SCATTERING AT VARIOUS LATITUDES

N. V. Mednikova and T. I. Zelenova *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 261-279 refs (For availability see N73-22314 13-13)

CSCL 04A

The space-time patterns of F-scattering of different intensity are examined from I = 0 to I = 89 N and for certain stations of the Southern Hemisphere. The maximum intensity and probability of F-scattering occurrence are observed on the magnetic equator and at the geomagnetic pole. In the equatorial latitudes in the quiet ionosphere case, F-scattering is observed regularly from 1900 to 0600 hours. Beginning at latitude phi is approximately = 20 deg, the nature of equatorial F-scattering and its cyclic, seasonal, and daily patterns change markedly, gradually taking on the nature of the high latitude F-scattering. Author

N73-22329* National Aeronautics and Space Administration, Washington, D.C.

CHANGE OF E SUB s WITH THE 11 YEAR CYCLE OF SOLAR ACTIVITY c29

O. Ovezgeldyyev *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 280-296 refs (For availability see N73-22314 13-13)

CSCL 03B

Results are presented of a study of Es variation with the 11-year solar activity cycle from the data of 10 ionospheric stations located in various latitudes. It is shown that the cyclic variations of PES, foE, and fbEs depend markedly on the time of day and season of the year. In the illuminated time, the overall probability of PES existence has negative correlation with the solar activity level, while foEs has positive correlation. In the unlighted time of day, the Es cyclic variation patterns are less clearly marked. It is shown that the observed cyclic variations of the Es layer are basically the result of indirect action of the cyclic absorption variations in the lower-lying ionospheric layers. Author

N73-22330* National Aeronautics and Space Administration, Washington, D.C.

FREQUENCY CHARACTERISTICS OF THE E SUB s LAYER

O. Ovezgeldyyev and A. Babayev *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 297-308 refs (For availability see N73-22314 13-13)

CSCL 04A

Results are presented of a study of the dependence of the fading frequency of a single signal reflected from the sporadic E layer on the frequency characteristics of this layer. It is shown that the nature of the fading of a single signal reflected from the Es layer for f work > fbEs depends significantly on foEs and fbEs, while for f work < fbEs there is no such dependence. Author

N73-22331* National Aeronautics and Space Administration, Washington, D.C.

LOCAL FOCI OF THE ANOMALOUS MIDDAY IONIZATION OF THE F2 LAYER IN THE TEMPERATE LATITUDES

A. S. Besprozvannaya and L. A. Yudovich *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 309-323 refs (For availability see N73-22314 13-13)

CSCL 04A

The distribution of F2-layer midday ionization is examined on a planetary station network using the analytic expression proposed previously for the geographic distribution of F2-layer midday ionization. It is found that in the temperate latitudes local F2-layer midday ionization anomaly foci are observed, which are most marked in the winter and summer solstice periods. In

the winter the anomalous region forms a band of low values occupying the latitude range 0 to 30 deg in the western sector of the Northern Hemisphere and 30 to 45 deg in the eastern sector. Anomalous foci are observed in the winter and summer months in the Caribbean and Japanese island regions. The possible factors causing these anomalies are discussed. Author

N73-22332*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

REMOTE SOIL MOISTURE MEASUREMENTS Final Report

E. H. Stockhoff, R. T. Frost, and E. J. Buerger Mar. 1973 31 p refs

(Contract NAS5-21689)

(NASA-CR-130211) Avail: NTIS HC $3.75 CSCL 08M

The degree of polarization of visible sunlight reflected from bare soils in agricultural test areas in the southwestern United States was measured by an airborne photopolarimeter. Surface soil specimens provided data concerning the surface moisture of the soil to which the polarization data were compared. The results indicate the feasibility of measuring soil surface moisture by airborne polarimeter instrumentation. Author

N73-22333*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

AN INTERPRETATION OF A GEOLOGIC MAP OF FANNIN COUNTY, TEXAS, PREPARED BY ADP TECHNIQUES FROM ERTS MSS DATA

J. A. Henderson, Jr., J. J. Gardner (Indiana State Univ.), and J. E. Cipra 1973 11 p refs Presented at Remote Sensing Conf., Tullahoma, Tenn., 26-28 Mar. 1973

(Contract NAS5-21785; Grant NGL-15-005-112)

(NASA-CR-131574; LARS-Inform-Note-031673) Avail: NTIS HC $3.00 CSCL 08G

Multispectral scanner data, collected by ERTS-1 from an area in northeast Texas underlain by structurally simple cretaceous sedimentary rocks, were analyzed using several automatic data processing techniques. Training areas for the computer analysis were selected in three ways using: (1) an unsupervised classifier, (2) the unsupervised classifier to further refine training areas, and (3) available ground information. The first two methods utilize the capability of the unsupervised classifier to group resolution elements with similar spectral properties. With the imagery produced by these procedures, several geologic features can be identified. The most easily recognizable features are streams and other water bodies. The approximate location of contacts between several rock units can be mapped. Author

N73-22334*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

URBAN LAND USE MAPPING BY MACHINE PROCESSING OF ERTS-1 MULTISPECTRAL DATA: A SAN FRANCISCO BAY AREA EXAMPLE

R. Ellefsen (Calif. State Univ., San Jose), P. H. Swain, and J. R. Wray (Geol. Surv.) 1973 16 p ref Presented at Conf. on Machine Processing of Remotely Sensed Data, Lafayette, Ind., 1973

(Grant NGL-15-005-112)

(NASA-CR-131589; LARS-Inform-Note-032973) Avail: NTIS HC $3.00 CSCL 08B

A study is reported to develop computer produced urban land use maps using multispectral scanner data from a satellite. Data processing is discussed along with the results of the San Francisco Bay area, which was chosen as the test area. F.O.S.

N73-22335# Joint Publications Research Service, Arlington, Va.

MARINE GEODESY

B. M. Malakhov 23 Apr. 1973 11 p Transl. into ENGLISH from Geod. i Kartografiya (Moscow), no. 2, 1973 p 19-25

(JPRS-58824) Avail: NTIS HC $3.00

A study of marine geodesy, based on materials from the 15th General Assembly of the International Union of Geodesy and Geophysics, is presented. Author

N73-22336*# California Univ., Berkeley. Forestry Remote Sensing Lab.

ANALYSIS OF REMOTE SENSING DATA FOR EVALUATION OF VEGETATION RESOURCES Remote Sensing Applications in Forestry. Annual Progress Report

30 Sep. 1970 176 p refs Prepared in cooperation with Dept. of Agric. Forest Serv.

(NASA Order R-03-038-002)

(NASA-CR-131580) Avail: NTIS HC $11.00 CSCL 02C

Research has centered around: (1) completion of a study on the use of remote sensing techniques as an aid to multiple use management; (2) determination of the information transfer at various image resolution levels for wildland areas; and (3) determination of the value of small scale multiband, multidate photography for the analysis of vegetation resources. In addition, a substantial effort was made to upgrade the automatic image classification and spectral signature acquisition capabilities of the laboratory. It was found that: (1) Remote sensing techniques should be useful in multiple use management to provide a first-cut analysis of an area. (2) Imagery with 400-500 feet ground resolvable distance (GRD), such as that expected from ERTS-1, should allow discriminations to be made between woody vegetation, grassland, and water bodies with approximately 80% accuracy. (3) Barley and wheat acreages in Maricopa County, Arizona, could be estimated with acceptable accuracies using small scale multiband, multidate photography. Sampling errors for acreages of wheat, barley, small grains (wheat and barley combined), and all cropland were 13%, 11%, 8% and 3% respectively. Author

N73-22337*# California Univ., Berkeley. Pacific Southwest Forest and Range Experiment Station.

THE USE OF MULTISPECTRAL SENSING TECHNIQUES TO DETECT PONDEROSA PINES TREES UNDER STRESS FROM INSECTS OR DISEASES Remote Sensing Applications in Forestry. Annual Progress Report No. 5

R. C. Heller, F. P. Weber, and K. A. Zealear Berkeley, Calif. Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1970 57 p refs Prepared for Calif. Univ., Berkeley, Forestry Remote Sensing Lab.

(NASA Order R-09-038-002)

(NASA-CR-131586) Avail: NTIS HC $5.00 CSCL 02F

The detection of stress induced by bark beetles in conifers is reviewed in two sections: (1) the analysis of very small scale aerial photographs taken by NASA's RB-57F aircraft on August 10, 1969, and (2) the analysis of multispectral imagery obtained by the optical-mechanical line scanner. Underexposure of all films taken from the RB-57 aircraft and inadequate flight coverage prevented drawing definitive conclusions regarding optimum scales and film combinations to detect the discolored infestations. Preprocessing of the scanner signals by both analog and digital computers improved the accuracy of target recognition. Selection and ranking of the best channels for signature recognition was the greatest contribution of digital processing. Improvements were made in separating hardwoods from conifers and old-kill pine trees from recent discolored trees and from healthy trees, but accuracy of detecting the green infested trees is still not acceptable on either the SPARC or thermal-contouring processor. From six years of experience in processing line scan data it is clear that the greatest gain in previsual detection of stress will occur when registered multispectral data from a single aperture or common instantaneous field of view scanner system can be collected and processed. Author

N73-22338*# California Univ., Berkeley. Rocky Mountain Forest and Range Experiment Station.

MULTISTAGE, MULTISEASONAL AND MULTIBAND IMAGERY TO IDENTIFY AND QUALIFY NON-FOREST VEGETATION RESOURCES Remote Sensing Applications in Forestry. Annual Progress Report No. 3

Richard S. Driscoll and Richard E. Francis Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1970 71 p refs Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab.

(NASA Order R-09-038-002)

(NASA-CR-131585; APR-3) Avail: NTIS HC $5.75 CSCL 02C

A description of space and supporting aircraft photography for the interpretation and analysis of non-forest (shrubby and herbaceous) native vegetation is presented. The research includes the development of a multiple sampling technique to assign

quantitative area values of specific plant community types included within an assigned space photograph map unit. Also, investigations of aerial film type, scale, and season of photography for identification and quantity measures of shrubby and herbaceous vegetation were conducted. Some work was done to develop automated interpretation techniques with film image density measurement devices. Author

N73-22339*# California Univ., Berkeley. Pacific Southwest Forest and Range Experiment Station.
THE USE OF SPACE AND HIGH ALTITUDE AERIAL PHOTOGRAPHY TO CLASSIFY FOREST LAND AND TO DETECT FOREST DISTURBANCES Remote Sensing Applications in Forestry. Annual Progress Report
R. C. Aldrich, W. J. Greentree, R. C. Heller, and N. X. Norick Berkeley, Calif. Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1970 41 p refs Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab.
(NASA Order R-09-038-002)
(NASA-CR-131584) Avail: NTIS HC $4.25 CSCL 02F

In October 1969, an investigation was begun near Atlanta, Georgia, to explore the possibilities of developing predictors for forest land and stand condition classifications using space photography. It has been found that forest area can be predicted with reasonable accuracy on space photographs using ocular techniques. Infrared color film is the best single multiband sensor for this purpose. Using the Apollo 9 infrared color photographs taken in March 1969 photointerpreters were able to predict forest area for small units consistently within 5 to 10 percent of ground truth. Approximately 5,000 density data points were recorded for 14 scan lines selected at random from five study blocks. The mean densities and standard deviations were computed for 13 separate land use classes. The results indicate that forest area cannot be separated from other land uses with a high degree of accuracy using optical film density alone. If, however, densities derived by introducing red, green, and blue cutoff filters in the optical system of the microdensitometer are combined with their differences and their ratios in regression analysis techniques, there is a good possibility of discriminating forest from all other classes. Author

N73-22340*# California Univ., Berkeley.
POTENTIALLY EFFICIENT FOREST AND RANGE APPLICATIONS OF REMOTE SENSING USING EARTH ORBITAL SPACE CRAFT, CIRCA 1980 Remote Sensing Applications in Forestry. Special Report
Richard C. Wilson 31 Jan. 1970 205 p refs Sponsored by NASA Prepared in cooperation with Dept. of Agric. Forest Serv.
(NASA-CR-131583) Avail: NTIS HC $12.25 CSCL 02F

Sixteen remote sensing applications or groups of related applications judged to be most important of any in the forestry and range disciplines were evaluated. In one application, major land classification, large amounts of useful data are anticipated to be contributed by space sensors in 1980. In four applications moderate amounts are anticipated to be so contributed. These are timber inventory, range inventory, fire weather forecasting, and monitoring snowfields. In the following seven applications small but significant amounts of data are anticipated to be contributed by space sensors: (1) detailed land classification; (2) inventory of wildlife habitat; (3) recreation resource inventory; (4) detecting stresses on the vegetation (5) monitoring air pollution caused by wildfires and prescribed burning; (6) monitoring water cycle, (7) pollution and erosion; and (8) evaluating damage to forests and ranges. Author

N73-22341*# California Univ., Berkeley. School of Forestry.
VIGOR LOSS IN CONIFERS DUE TO DWARF MISTLETOE Remote Sensing Applications in Forestry. Annual Progress Report No. 1
Merle P. Meyer, D. W. French, Robert P. Latham, and Charles A. Nelson Berkeley, Calif. Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1970 25 p refs Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab. in cooperation with Dept. of Agric. Forest Serv.
(NASA Order R-09-038-002)
(NASA-CR-131582; APR-1) Avail: NTIS HC $3.25 CSCL 02F

Practical remote sensing techniques were developed for detecting and evaluating vigor loss in forest conifers due to dwarf mistletoe. Eastern dwarf mistletoe (Arceuthobium pusillum) infection of black spruce (Picea mariana) was investigated. A tower-tramway system, 100 feet high, was erected over an infected stand in northeast Minnesota in June and multiband/multidate photography was initiated in July and is continuing. Four 70mm film-filter combinations were used in a multicamera unit: Plus-X/Wratten 58, Plus-X/Wratten 25A, Aero Infrared/Wratten 89B, and Ektachrome Infrared/Wratten 12. The stand of mistletoe-infected black spruce under the tramway was photographed three times per day (0900, 1200 and 1500 local sun time) at approximately 10 day intervals. An extensive test site, several square miles in area, was selected in north-central Minnesota for the purpose of testing photographic specifications developed on the tramway test site. One aerial photographic flight at a variety of altitudes was accomplished over the extensive test site in August. Data analyses are not available at this time. Author

N73-22342*# California Univ., Berkeley. Dept. of Range Management.
INVENTORY OF NATIVE VEGETATION AND RELATED RESOURCES FROM SPACE PHOTOGRAPHY Remote Sensing Applications in Forestry. Annual Progress Report
Charles E. Poulton, James R. Johnson, and David A. Mouat Berkeley, Calif. Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1970 39 p refs Sponsored by NASA Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab. in cooperation with Dept. of Agric. Forest Serv.
(NASA-CR-131581) Avail: NTIS HC $4.00 CSCL 02F

The application of space and high flight photography to vegetational resources in Arizona is discussed. Ecologically based vegetation-landform and land use maps are prepared. The use of material from the Apollo 9 flight and high flight aerial photography are discussed. Land uses that result in a conversion or strong modification of the natural vegetation are presented. The vegetation-landform units have an ecological basis and are meaningful from a land use point of view because they identify areas with unique potentials or limitations for use or development under various land uses. Examples of these relationships are given. Author

N73-22343# Massachusetts Inst. of Tech., Cambridge. Urban Systems Lab.
A SURVEY OF NATIONAL GEO-CODING SYSTEMS
Pamela A. Werner Feb. 1972 173 p refs
(Contract DOT-OS-10058)
Avail: NTIS HC $10.75

A description is made of the major national geo-coding system presently employed to manage diverse geographic data. The general characteristics considered in these systems include their structural elements, applicability, and universality. Emphasis was placed on scope rather than depth to allow for the study of a greater number of systems. J.M.M.

N73-22344*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
BASIC FOREST COVER MAPPING USING DIGITIZED REMOTE SENSOR DATA AND AUTOMATED DATA PROCESSING TECHNIQUES
Michael E. Coggeshall and Roger M. Hoffer 1973 131 p refs
(Grant NGL-15-005-112)
(NASA-CR-131578; LARS-Inform-Note-030573) Avail: NTIS HC $8.75 CSCL 08B

Remote sensing equipment and automatic data processing techniques were employed as aids in the institution of improved forest resource management methods. On the basis of automatically calculated statistics derived from manually selected training samples, the feature selection processor of LARSYS selected, upon consideration of various groups of the four available spectral regions, a series of channel combinations whose automatic classification performances (for six cover types, including both deciduous and coniferous forest) were tested, analyzed, and further compared with automatic classification results obtained from digitized color infrared photography. Author

N73-22345*# California Univ., Berkeley.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Semiannual Progress Report
Robert N. Colwell 31 Dec. 1972 411 p refs Original contains color illustrations
(Grant NGL-05-003-404)
Avail: NTIS HC $22.75 CSCL 08B

The earth resources study for California is reported. The objectives, user needs, water management, data acquisition, data processing, and atmospheric effects in image transfer are discussed. F.O.S.

N73-22346*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
RECOGNITION OF SURFACE LITHOLOGIC AND TOPOGRAPHIC PATTERNS IN SOUTHWEST COLORADO WITH ADP TECHNIQUES
William N. Melhorn and Scott Sinnock 1973 9 p refs
(Grant NGL-15-005-112)
(NASA-CR-131577; LARS-030273) Avail: NTIS HC $3.00 CSCL 08B

Analysis of ERTS-1 multispectral data by automatic pattern recognition procedures is applicable toward grappling with current and future resource stresses by providing a means for refining existing geologic maps. The procedures used in the current analysis already yield encouraging results toward the eventual machine recognition of extensive surface lithologic and topographic patterns. Automatic mapping of a series of hogbacks, strike valleys, and alluvial surfaces along the northwest flank of the San Juan Basin in Colorado can be obtained by minimal man-machine interaction. The determination of causes for separable spectral signatures is dependent upon extensive correlation of micro- and macro-field-based ground truth observations and aircraft underflight data with the satellite data. Author

N73-22347*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PREPARATION OF URBAN LAND USE INVENTORIES BY MACHINE-PROCESSING OF ERTS MSS DATA
William Todd, Paul Mausel, and Kenneth Wenner 1973 9 p ref
(Grant NGL-15-005-112)
(NASA-CR-131576; LARS-022873) Avail: NTIS HC $3.00 CSCL 08F

Spectral classes of urban phenomena identified from ERTS multispectral scanner data in Milwaukee included Surburban, Inner City, Industry, Grassy (open area), Road, Wooded Suburb, Water, Cloud, and Shadow. The Milwaukee spectral class statistics were used to classify the Chicago area, within the same ERTS frame, and similar results were achieved. In another ERTS frame, Marion County (Indianapolis) data were classified into similar classes. The Marion County ERTS study was supported by a land use classification of an area near downtown Indianapolis that utilized 12-band MSS data collected by aircraft from 3000 feet. The results of the ERTS analyses suggest that satellite data will be a useful tool for the urban planner for monitoring urban land use. Author

N73-22348*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
MULTISPECTRAL DETERMINATION OF VEGETATIVE COVER IN CORN CROP CANOPY
E. R. Stoner and M. F. Baumgardner Jun. 1972 126 p refs
(Grant NGL-15-005-112)
(NASA-CR-131575; LARS-Print-111072) Avail: NTIS HC $8.50 CSCL 02C

The relationship between different amounts of vegetative ground cover and the energy reflected by corn canopies was investigated. Low altitude photography and an airborne multispectral scanner were used to measure this reflected energy. Field plots were laid out, representing four growth stages of corn. Two plot locations were chosen—on a very dark and a very light surface soil. Color and color infrared photographs were taken from a vertical distance of 10 m. Estimates of ground cover were made from these photographs and were related to field measurements of leaf area index. Ground cover could be predicted from leaf area index measurements by a second order equation. Microdensitometry and digitization of the three separated dye layers of color infrared film showed that the near infrared dye layer is most valuable in ground cover determinations. Computer analysis of the digitized photography provided an accurate method of determining percent ground cover. Author

N73-22349# National Environmental Satellite Service, Washington, D.C.
PUBLICATIONS AND FINAL REPORTS ON CONTRACTS AND GRANTS, 1972 - NESS
Apr. 1973 15 p refs
(NOAA-TM-NESS-46) Avail: NTIS HC $3.00

A listing is provided of articles and reports published by or for the National Environmental Satellite Service. Author

N73-22350# Advisory Group for Aerospace Research and Development, Paris (France).
TOTAL ELECTRON CONTENT AND SCINTILLATION STUDIES OF THE IONOSPHERE
Jules Aarons, ed. (AFCRL) Mar. 1973 112 p refs
(AGARD-AG-166; AGARDograph-166) Avail: NTIS HC $7.75

The current state of knowledge of ionospheric total electron content is outlined, with special emphasis placed on the North Atlantic region of the world due to NATO special requirements in this region. A numerical model of total electron content, valid over the European continent under certain conditions, is presented for systems engineering use for an average background total electron content correction. Typical values of total electron content are also given at various locations in the high, middle and equatorial latitudes. With more observational data being taken at many locations, an overall satisfactory picture of the world wide behavior of this important parameter is beginning to emerge. Author

N73-22351# Bureau of Meteorology, Victoria (Australia).
OCEAN WAVES AT PORT PHILLIP HEADS
R. L. Falconer Apr. 1972 145 p refs
Avail: NTIS HC $9.25

The effects of refraction, shoaling and friction on ocean waves reaching Port Phillip Heads, Australia, have been computed. Deep water wave characteristics computed for the point lat 39 deg S, long 145 deg E, for a period of 15 years (1951-65) have been converted to wave characteristics at the entrance to the ship channel through the Heads by applying corrections for these shallow water effects. Statistical summaries of wave heights, periods and directions, their time durations and their variation with time of year are presented in tables and diagrams. Author

N73-22352*# Kentucky Research Foundation, Lexington.
RADIOCHEMISTRY AS APPLIED TO GEOCHEMICAL PROBLEMS: NEUTRON ACTIVATION ANALYSIS Final Report
James Y. McDonald 14 Jan. 1972 39 p refs
(Grant NGR-18-001-058; Contract AT(40-1)-2670)
(NASA-CR-131831; ORO-2670-47) Avail: NTIS HC $4.00 CSCL 08G

The use of neutron activation for analysis of geochemical samples is discussed and reports on research in this area listed. NSA

N73-22353# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires.
AN ATTEMPT TO DETERMINE THE LONGITUDINAL DRIFT OF PC 1 PULSES [TENTATIVE DE DETERMINATION DE LA DERIVE EN LONGITUDE DES PULSATIONS DE TYPE PC1]
F. Jeunesse 2 Oct. 1972 54 p refs In FRENCH
(CEPHAG-22/72) Avail: NTIS HC $4.75

The possibility of measuring the longitudinal source drift rate of a PC 1 geomagnetic micropulsation event is investigated. The method is based on the intercorrelation of signals received from interspaced stations. Experimental techniques are described and include signal recording and processing, especially for signal to noise measurement. The PC 1 frequency spectrum runs from 0.2 to 5 Hz. An experiment for measuring the drift showed how to measure the energy of the particles responsible for the PC 1 emissions from the ground. ESRO

N73-22354# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Aug. 1972 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, AOUT 1972]
Aug. 1972 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray(neutron component) observations at Dourbes (Belgium) are tabulated for August 1972. ESRO

N73-22355# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA. DATA SUMMARY 72/7-9 JULY-SEPTEMBER 1972
L. Liszka, ed. 1972 68 p Prepared jointly with European Space Sounding Rocket Range
Avail: NTIS HC $5.50

Data are presented which were recorded at Kiruna Geophysical Observatory in Sweden from July to September, 1972, concerning geomagnetic variations, ionospheric absorption, geomagnetic K-indices, and periodic variations of cosmic noise absorption. ESRO

N73-22356# Institute of Geological Sciences, London (England).
ESKDALEMUIR, HARTLAND AND LERWICK OBSERVATORIES. MAGNETIC RESULTS 1969
1973 159 p
(Geomagnetic-Bull-3) Avail: NTIS HC $10.00; HMSO £4.00; PHI $15.50

Tables of hourly values, daily means, and sums of the magnetic declination west, and the horizontal and vertical components of the geomagnetic field intensity recorded at Eskdalemuir, Hartland, and Lerwick observatories (England) are presented along with daily ranges, K-indices, and variometer baseline values. ESRO

N73-22357# Danish Meteorological Inst., Charlottenlund. Dept. of Geophysics.
THULE GEOPHYSICAL OBSERVATORY, MAGNETIC RESULTS, 1947
E. Ulander 1972 39 p refs
Avail: NTIS HC $4.00

Tables of hourly and daily means of the magnetic declination and the horizontal and vertical components of the magentic field intensity recorded at Thule, Greenland, in 1947, are presented along with daily ranges and variometer baseline values. ESRO

N73-22358# Danish Meteorological Inst., Charlottenlund. Dept. of Geophysics.
THULE GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS, 1948
E. Ulander 17 Jan. 1972 37 p refs
Avail: NTIS HC $4.00

Tables of hourly and daily means of the magnetic declination and the horizontal and vertical components of the magnetic field intensity recorded at Thule, Greenland, in 1948, are presented along with daily ranges and variometer baseline values. ESRO

N73-22359# Danish Meteorological Inst., Charlottenlund. Dept. of Geophysics.
THULE GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS, 1949
E. Ulander 18 Jan. 1972 39 p refs
Avail: NTIS HC $4.00

Tables of hourly and daily mean values of the magnetic declination and the horizontal and vertical components of the geomagnetic field intensity recorded at Thule, Greenland, in1949, are presented along with daily ranges and variometer baseline values. ESRO

N73-22360# Texas Instruments, Inc., Dallas. Services Group.
EXTENDED ARRAY EVALUATION PROGRAM Final Report, 1 Apr. 1971 - 31 Mar. 1972
Terence W. Harley 31 Mar. 1972 50 p refs
(Contract F33657-71-C-0843; ARPA Order 1714; AFTAC Proj. VT/1705)
(AD-756905) Avail: NTIS CSCL 17/10

Summarized is the material covered in each of the special reports and the conclusions obtained are discussed. The individual tasks covered include evaluations of the Alaskan Long Period Array, the long period Norwegian Seismic Array, the short period Norwegian Seismic Array, and the stations of the Very Long Period Experiment. In addition studies of network capabilities and analysis techniques, of adaptive processing techniques, and of high-resolution frequency wavenumber spectral techniques are reported. Author (GRA)

N73-22361# Texas Instruments, Inc., Dallas. Services Group.
ADAPTIVE CONVERGENCE STUDIES. EXTENDED ARRAY EVALUATION PROGRAM Special Report
Aaron H. Booker, Chung-Yen Ong, and Thomas E. Barnard 30 Apr. 1972 40 p ref
(Contract F33657-71-C-0843; ARPA Order 1714; AFTAC Proj. VT/1705)
(AD-756904; TI-SR-1) Avail: NTIS CSCL 17/10

The purpose of the study is to investigate the ability of a modified adaptive algorithm to increase the convergence rate on weak noise components. A detailed mathematical derivation of the modified algorithm is presented. In addition, performance of the algorithm on synthetic data is evaluated. The algorithm is applied in both a single loop and a two-loop mode. Both single-constraint and multiple-constraint modes of operation are investigated. The results of the study indicate that the multiloop adaptive filtering algorithm can be used to speed the rate at which an adaptive filter set approaches optimality. Author (GRA)

N73-22362# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
PHOTOELECTRON PROCESSES
Wesley E. Swartz 1972 16 p refs
(Contract N00014-67-A-0077-0029; ARPA Order 2266)
(AD-756241; TR-1) Avail: NTIS CSCL 04/1

The problem of calculating electron and ion temperatures for theoretical ionospheric models is complicated by photoelectron transport (i.e. non-local effects) in the upper F2 region. Since former computer programs which restrict the flux distribution function do not provide consistent fluxes, a new generalized method was developed. GRA

N73-22363# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ATMOSPHERIC DENSITY RESULTS DERIVED FROM THE SPADES SATELLITE ACCELEROMETER DATA
Frank A. Marcos, Robert McInerney, Janice Corbin, Robert W. Fioretti, and Neil Grossbard 12 Oct. 1972 182 p refs
(AF Proj. 6690)
(AD-756831; AFCRL-72-0608; AFCRL-ERP-417) Avail: NTIS CSCL 04/1

The report describes density results obtained from the ultrasensitive triaxial accelerometer system flown on the Air Force low-altitude density research satellite OV 1-15 (SPADES). A description of the spacecraft operation, the accelerometers, and the data reduction procedure is also given. The accelerometers measured the satellite deceleration induced by aerodynamic drag. Profiles of the neutral atmospheric density were derived directly from the drag data. Measurements were made from an altitude of 250 km down to perigee, nominally 160 km. Density profiles acquired from 14 July 1968 to 28 September 1968 are presented as Appendix A. Comparison of the density results to the appropriate Jacchia 1971 model atmosphere is given in Appendix B. Author (GRA)

N73-22364# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
RESEARCH ON HIGH-ALTITUDE PLASMA PHYSICS Final Report, 1 Jul. 1966 - 15 Sep. 1972
David L. Morse, William W. Destler, Peter L. Auer, and Isaiah Nebenzahl Mar. 1973 87 p refs
(Contract N00014-67-A-0077-0002)
(AD-756684) Avail: NTIS CSCL 04/1

The report contains a summary of problems investigated related to High-Altitude Plasma Physics. References to detailed work in this area are given. The topics investigated fall into four general categories: (1) propagation of, and radiation from, relativistic electron beams, (2) plasma dynamics, shockwaves, and atomic collision processes, (3) plasma turbulence, and (4)

theoretical studies. A detailed technical report on experiments simulating the release of artificial plasma clouds in the ionosphere is given. The results of these experiments are in substantial agreement with current theories of the motion and deformation of such clouds. Author (GRA)

N73-22365# Teledyne Geotechnical, Garland, Tex.
LOW FREQUENCY EARTH MOTION GENERATED BY SLOWLY PROPAGATING, PARTIALLY ORGANIZED PRESSURE FIELDS
G. G. Sorrells and T. T. Goforth 23 Oct. 1972 39 p refs
(Contract F33657-70-C-0646; Grant AF-AFOSR-2133-71)
(AD-755527; TR-72-20) Avail: NTIS CSCL 08/11

General expressions for the transfer function and the coherence relating earth motion and atmospheric pressure variations observed at the surface are derived for the case where the pressure field is a random process which is stationary in both time and space. It is found that as long as the phase velocities of the pressure field are low in comparison to seismic wave velocities this transfer function will be a smoothed version of the earth's response to a point pressure load applied at the surface. The form of the smoothing operator is determined by the correlation structure of the pressure field. In particular it was found that the transfer function of an analytical model which possesses all of the observed statistical properties of the wind generated pressure field closely resembles those associated with plane pressure waves. Author (GRA)

N73-22366# Aerospace Corp., El Segundo, Calif. Lab. Operations.
GEOMAGNETIC POTENTIAL IN OFFSET-DIPOLE COORDINATES Final Report, Jan. - Sep. 1972
Henry H. Hilton and Michael Schulz 18 Dec. 1973 25 p refs
(Contract F04701-72-C-0073)
(AD-756460; TR-0073(3260-20)-14; SAMSO-TR-73-40) Avail: NTIS CSCL 08/14

The geomagnetic potential (IGRF 1965.0) is converted into the spherical coordinates of an optimally offset and inclined dipole by means of a least-squares fit to the transformed Schmidt coefficients. Time derivatives of the resulting spherical-harmonic expansion coefficients are obtained by taking symmetric first differences (1966.0 vs 1964.0). Author (GRA)

N73-22367# Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
TERRAIN FACTOR ANALYSIS AND AUTOMATIC COLOR CODED MAPPING UTILIZING THE IDECS (IMAGE DISCRIMINATION, ENHANCEMENT, COMBINATION AND SAMPLING) Final Technical Report
Philip Currier Aug. 1972 71 p refs
(Contract DAAK02-71-C-0474; DA Proj. 4A6-62707-A-854)
(AD-755531; CRES-TR-208-1; ETL-CR-72-13) Avail: NTIS CSCL 08/2

The report describes a technique for automatic generation of color-coded maps which define the amount of time required to construct a military airfield. The input data is a set of terrain factors in overlay form and the technique relies upon the use of the IDECS System (Image Discrimination, Enhancement, Combination and Sampling) of the Center for Research, Inc., University of Kansas. The color-coded map is generated by a PDP-15/20 computer which reads the terrain factors which have been previously stored on the IDECS disc and applies them to a model in memory which calculates the amount of time for the airfield construction on a point by point basis. The computer then sorts the output into preselected time intervals and writes them on a digital disc. The appropriate disc channels are then displayed via the IDECS on a color television monitor for viewing as a composite color map. Author (GRA)

N73-22368# Army Coastal Engineering Research Center, Washington, D.C.
COASTAL IMAGERY DATA BANK Interim Report
Andre Szuwalski Nov. 1972 55 p
(AD-755508; CERC-Misc-Paper-3-72) Avail: NTIS CSCL 08/2

Report provides information about a Coastal Imagery Data Bank being compiled by CERC. The data bank will consist of a systematic index identifying available aerial photographs of the coastal areas of the United States. Compilation is scheduled for completion in fiscal year 1977. This interim report covers data compiled through fiscal year 1972. Imagery for the index is compiled by the Defense Manning Agency Topographic Center (DMATC) under support and direction of CERA. Author (GRA)

N73-22369# Army Electronics Command, Fort Monmouth, N.J.
INVESTIGATION OF THE DIURNAL GEOMAGNETIC VARIATION
Hans A. Bomke and Arthur K. Harris Dec. 1972 92 p refs
(DA Proj. 1T0-61102-B-31A)
(AD-755787; ECOM-4066) Avail: NTIS CSCL 08/14

It is found that existing theories do not account for all the complex phenomena involved in the diurnal geomagnetic variation. For example, an early-morning anomaly and an afternoon anomaly, not previously educed, are described, and their seasonal and geographic character are studied; their existence requires considerable modification of the currently accepted, hypothesized ionospheric-current system, as well as of the underlying atmospheric-dynamo theory. The authors introduce the daytime range as a useful characterization of the diurnal variation; its day-to-day variability is shown to be uncorrelated with solar activity, and is consequently presumed to have a terrestrial cause. Daytime range is also used to investigate the correlation of diurnal variation between stations as a function of distance and season. There are many indications that large-scale weather systems affect the ionospheric currents. Author (GRA)

N73-22370# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
LOWER THERMOSPHERE DENSITY VARIATIONS IN THE SOUTHERN HEMISPHERE
F. A. Marcos, K. S. W. Champion, and R. W. Fioretti (Boston Coll.) 1 Dec. 1972 24 p refs Presented at the 14th COSPAR Meeting, Seattle, 17 Jun. - 2 Jul. 1970
(AF Proj. 6690)
(AD-755396; AFCRL-72-0703) Avail: NTIS CSCL 04/1

Profiles of the neutral atmospheric density have been obtained at high and middle latitudes in the southern hemisphere from OV1-15 (SPACES) satellite accelerometer measurements. The data were obtained during a geomagnetically quiet period near the equinox, 24-28 September 1968, when the satellite was in a nearly down-dusk orbit. Perigee moved from 50 degrees S to 65 degrees S during this period. Measurements were made in the altitude range 170-250 km. Density values at dusk at high latitudes (before perigee) are less than those at midlatitudes (after perigee). The average difference between the high latitude and midlatitude data is 15 percent. A longitudinal variation is superimposed on the latitudinal gradients. Enhanced densities at high southern latitudes are found at longitudes near the south geomagnetic pole. Author (GRA)

N73-22371# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COESA TASK GROUP 1 REPORT ON PROPOSED 50 TO 100 km REVISION TO US STANDARD ATMOSPHERE 1962 Environmental Research Papers
Allen E. Cole and Arthur J. Kantor 27 Nov. 1972 20 p refs
(AF Proj. 8624)
(AD-755394; AFCRL-72-0692; AFCRL-ERP-422) Avail: NTIS CSCL 04/1

A proposed revision to U. S. Standard Atmosphere 1962 developed by COESA Task Group I is presented for levels between 50 and 100 km. The proposed revision is based on rocket observations taken through 1971. It has a temperature-altitude profile that is approximately 10C colder the 1962 standard at 60 Km, nearly 20C warmer at 80 km, and 8C colder at 100 km. Densities associated with the proposed temperature-altitude profile are 8 to 9 percent lower than the 1962 standard at levels between 70 and 80 km and 10 to 20 percent greater at 90 and 100 km, respectively. Variations with latitude in the mean annual temperatures and densities are shown for levels between 50 and 100 km. Author (GRA)

N73-22372# Dayton Univ. Research Inst., Ohio.
RESEARCH STUDIES ON ATMOSPHERIC ELECTRICITY Final Report, Sep. 1971 - Oct. 1972

Joseph T. Swartzbaugh and Donald A. Kahle Dec. 1972 10 p
(Contract F19628-71-C-0045; AF Proj. 8620)
(AD-755400; AFCRL-72-0742) Avail: NTIS CSCL 04/1

The report describes the work involving the design of an RB-57F wing pod suitable for carrying conductivity and electric field instrumentation and a 16mm camera, processing of some previously obtained meteorological data and the generation of some computer programs to accomplish this processing, and the development of computer software for data reduction to be used in conjunction with the AFCRL meteorological airborne data system when used in atmospheric electricity studies.
Author (GRA)

N73-22373# Raytheon Service Co., Burlington, Mass.
RADAR WAVE DIRECTION SENSORS FOR COASTAL RESEARCH
Walter L. Mudgett and Raymond C. Remington 22 Jun. 1972 143 p refs
(Contract DACW72-72-C-0008)
(AD-755241) Avail: NTIS CSCL 08/3

The primary objective of the study was to assess the feasibility of using a radar system to measure the direction of arrival of ocean waves arriving at a shoreline. GRA

N73-22374# Wisconsin Univ., Middleton. Geophysical and Polar Research Center.
SONAR MAPPING OF THE UNDERSIDE OF SEA ICE Final Research Report
C. S. Clay, J. M. Berkson, and T. K. Kan Feb. 1972 22 p refs
(Contract N00014-67-A-0128-0019; ARPA Order 1783)
(AD-755243; RR-73-1; Contrib-293) Avail: NTIS CSCL 08/12

A technique was developed for adapting the side-scan sonar to obtain sonar maps of the undersurface of sea ice. The equipment is portable and air-mobile operations were made from single-engine light aircraft. Graphic records displaying the range and relative scattering strengths at 48 kHz were assembled into sonar maps that display the location and shape of under ice features. Data were taken at five sites in the Arctic. The purpose of the research is to develop the underwater technology required to measure the location and shape of features on the bottom of sea ice and to compare the bottom with features on the surface; and to study the scattering of sound from the water-ice interface. GRA

N73-22375# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
CONTINUOUS OBSERVATIONS OF THE STRUCTURAL CHANGES IN DEFORMING POLYCRYSTALLINE ICE
Robert M. Sprenger Nov. 1972 77 p refs
(Contract N00014-67-A-0103-0007; NR Proj. 307-252)
(AD-755336) Avail: NTIS CSCL 08/13

An apparatus was constructed to continuously observe structural changes accompanying the deformation of polycrystalline ice. Thin sections of natural glacier ice and arctic sea ice were subjected to compressive stresses of several bars at temperatures near the melting point. Polarized light was used to obtain photographic sequences of the deformation. The observations were designed so as not to interrupt the deformation, in contrast to previous studies. Grain boundary migration and basal glide were observed over a wide range of stresses and temperatures, while polygonization and various types of recrystallization were found to be restricted to smaller stress-temperature regions. No voids or cracks were observed to form in the ice during these experiments. Regelation and intercrystalline sliding were not detected. Photographs and tracings of the deformation sequences are presented, together with other quantitative data related to the observations. Author (GRA)

N73-22376# Ocean and Atmospheric Science, Inc., Dobbs Ferry, N.Y.
ENVIRONMENTAL IMPACT STUDY Final Technical Report, 14 Apr. - 31 Oct. 1972
Julius Woolf 8 Nov. 1972 422 p refs
(Contract N00014-72-C-0425; ARPA Order 2195; NR Proj. 089-090)
(AD-754458; OAS-TR-72-116) Avail: NTIS CSCL 13/2

The Defense Advanced Research Projects Agency's (ARPA) Environmental Impact Program is directed toward identifying those scientific and technical areas necessary to achieve satisfactory evaluation and abatement of the environmental impacts of Department of Defense (DOD) activities. The report discusses research from this program and involves high technology problems for which there are current voids not being adequately addressed by others and for which the environmental evaluations require considerable inter-service and inter-agency participation. Presented are recommendations for new facilities and techniques. These include: An Environmental Impact Prediction Facility to assist in evaluating impact on the environment and to provide a data base; Implementation of a model base facility in which all the environmental factors and natural resources could be well controlled; Development of sensor and instrumentation techniques for environmental monitoring; Study of critical materials to assure a DOD supply; Environmental management so that DOD's pollution efforts will be recognized by the civilian community; and Pilot project to achieve insight and know-how prior to the start of the actual Environmental Impact Prediction Facility. Also described is an effort toward identifying research needed to support future environmental impact statements. Assessment and evaluation of current impact statements were used to determine potential difficulties. GRA

N73-22377# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
GEOMORPHIC COASTAL VARIABILITY, NORTHWESTERN AUSTRALIA
Lynn D. Wright, James M. Coleman, and Bruce G. Thom Jan. 1973 33 p refs Repr. from Coastal Studies Bull. 7
(Contract N00014-69-A-0211-0003; NR Proj. 388-002)
(AD-755154; TR-129) Avail: NTIS CSCL 08/6

Interactions of dynamic processes such as wind, ocean waves, tides, littoral currents, river flow, and biological and chemical activity cause variations in worldwide coastal landscapes. Successful operational procedures must therefore consider these environmental factors, and predictive capabilities will be possible only when these process-form relationships are thoroughly understood. The coastline from Darwin, Australia, to the western limit of the Joseph Bonaparte Gulf displays a wide variety of coastal landscapes in a region characterized by low wave energy, extreme tidal range, and a tropical monsoon climate. Ten discrete coastal provinces were identified along this 950-mile coastline, and the variations in the coastal landforms between these provinces are attributed to varying combinations of nearshore processes. Thus a link between nearshore processes and coastline characteristics has been established for a certain combination of environmental conditions. Author (GRA)

N73-22378# Argonne National Lab., Ill. Chemical Engineering Div.
THE ISOTOPIC COMPOSITION OF ATMOSPHERIC CARBON MONOXIDE Final Report
C. M. Stevens, L. Krout, D. Walling, A. Venters, and A. Engelkemeir Sep. 1972 52 p refs Sponsored in part by AEC, EPA, and Coordinating Res. Council
(PB-213591; CRC-APRAC-CAPA-4-68-4) Avail: NTIS CSCL 04A

The concentration and the carbon and oxygen isotopic composition of atmospheric CO of the northern hemisphere show regular seasonal variations. The isotopic pattern is different from that for CO from automobile engine combustion whether compared to combustion in the same region as the air sample or to an estimated world average. These results indicate that there are several natural sources, one of which is much greater than anthropogenic emissions. The most likely nature of these sources is discussed and the production rates are estimated.
Author (GRA)

N73-22379*# Stanford Univ., Calif. Inst. for Plasma Research.
INFERRING THE INTERPLANETARY MAGNETIC FIELD BY OBSERVING THE POLAR GEOMAGNETIC FIELD
John M. Wilcox Jun. 1972 27 p refs
(Grant NGL-05-020-559; Grant NGL-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138; NR Proj. 323-003)
(NASA-CR-131609; AD-747966; SU-IPR-477) Avail: NTIS HC

$3.50 CSCL 03/2

Svalgaard and Mansurov have shown that it is possible quite reliably to infer the polarity of the interplanetary magnetic field from observations of the diurnal variation of polar geomagnetic fields. The effect is most prominent during several hours near noon in the vertical component of geomagnetic observatories near the geomagnetic poles, such as Thule and Vostok. The interplanetary magnetic field observed with spacecraft near the earth is very similar to the mean solar magnetic field (i.e. the sun observed as though it were a star), so the fact that observations of the polar geomagnetic field exist without interruption since 1926 at the Danish Meteorological Institute station at Godhavn, Greenland, means that effectively the inferred solar magnetic field during five sunspot cycles is available for analysis. The specific nature of the relation between the interplanetary field and the polar geomagnetic field should aid toward physical understanding of the interaction between the two fields.

Author (GRA)

N73-22380# Comstock and Wescott, Inc., Cambridge, Mass.
MODIFICATION OF DOUBLE-DECK EUV SPECTROPHOTOMETER Final Report, 1 Sep. 1971 - 31 Aug. 1972
Joseph Padur, P. 16 Oct. 1972 30 p
(Contract F19628-72-C-0048; AF Proj. 6688)
(AD-756917; AFCRL-72-0738) Avail: NTIS CSCL 04/1

The report describes the refurbishment and modification of a double-deck extreme ultraviolet spectrophotometer recovered from a previous rocket flight. In addition, the report discusses the preparation and launching of two solar extreme ultraviolet spectrophotometers as scientific payloads on sounding rockets.

Author (GRA)

N73-22381# Army Foreign Science and Technology Center, Charlottesville, Va.
SIZE DISTRIBUTION OF NATURAL AEROSOL PARTICLES
S. Savkisov 22 Dec. 1972 12 p Transl. into ENGLISH of Tr. Vysokogorn. Geofiz. Inst. (Leningrad), No. 13, 1969 p 88-96
(AD-756051; FSTC-HT-23-2044-72) Avail: NTIS CSCL 04/1

The authors present results of a large number of terrestrial measurements in the USSR of the concentrations and spectral distributions of natural aerosols at various times of the year, obtained with the aid of an impactor. GRA

N73-22382# Technology International Corp., Bedford, Mass.
HIGH RESOLUTION OPTICAL MEASUREMENTS OF ARPA PROJECT SECEDE 2 Final Report, 30 Jul. 1971 - 30 Oct. 1972
Wallace P. Boquist, Robert W. Deuel, Stanley G. Hawks, Patricia L. Crawley, and Dennise E. Overbye Griffiss AFB, N. Y. RADC Nov. 1972 72 p
(Contract F30602-71-C-0364; ARPA Order 1057; Proj. Secede)
(AD-756938; TIC-734; RADC-TR-72-307) Avail: NTIS CSCL 04/1

High resolution optical measurements were made of a series of high altitude barium releases at Eglin AFB during January 1971. Data was obtained on the individual cloud motions (ion and neutral), morphology, and fine structure striation development viewed up the geomagnetic field lines. Author (GRA)

N73-22572 Joint Publications Research Service, Arlington, Va.
STATISTICAL DESCRIPTION OF THE WIND FIELD IN THE UPPER TROPOSPHERE AND LOWER STRATOSPHERE CONSIDERING THE SCALE OF MOTION
N. Z. Pinus and V. A. Shnaydman *In its* Meteorol. and Hydrol., No 2, Feb. 1973 19 Apr. 1973 p 1-17 refs (For availability see N73-22571 13-20)

N73-22574 Joint Publications Research Service, Arlington, Va.
NUMERICAL FORECASTING OF THE BAROMETRIC FIELD IN THE STRATOSPHERE
I. V. Bugayeva and G. R. Zakharov *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 29-39 refs (For availability see N73-22571 13-20)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-22383 Ohio State Univ., Columbus.
COMPARATIVE STUDY OF POINT MARKING DEVICES AND THEIR SUITABILITY FOR PHOTOGRAMMETRIC PROBLEMS Ph.D. Thesis
Joseph Paul Okang 1972 160 p
Avail: Univ. Microfilms Order No. 72-27073

Several point marking devices have been manufactured to meet the demand for high accuracy requirements of analytical methods of photogrammetry, and as a result, the photogrammetrist is confronted with a number of these devices with wide ranges in cost, construction and operation. One hundred and eighty-two points were marked and transferred on high quality photographs with each of four point marking devices--PUG2, PUG4, Snap Marker and Multiscale. The errors were measured with three coordinate measuring instruments. Analysis of variance techniques were used to analyze the errors and to compare the point marking devices as well as the coordinate measuring instruments. All the marked points were used in a relative orientation operation and the resulting variances were compared statistically. Dissert. Abstr.

N73-22384 George Washington Univ., Washington, D.C.
THE FEASIBILITY OF DETECTING SUBSURFACE COAL FIRES IN WYOMING AND MONTANA FROM THE GROUND, ON AERIAL PHOTOGRAPHY AND ON SATELLITE IMAGERY Ph.D. Thesis
George A. Rabchevsky 1972 423 p
Avail: Univ. Microfilms Order No. 72-25062

An investigation was made to determine the usefulness of ground, aircraft and satellite remote sensing methods for the detection of surface and subsurface coal fires burning in north central Wyoming and southern Montana. Field studies were conducted during the spring, summer and fall seasons and used as back-up information for the analysis of available satellite imagery and aerial multispectral photography, provided by the U.S. Bureau of Mines. Ground observations were the most effective and reliable method for the detection of coal fires. Usefulness of the available aerial fall-season multispectral photography was marginal and the examination of the existing satellite imagery, applicable for the detection of coal fires on the ground, was the least productive. Suggestions and recommendations are presented for future more effective photographic aircraft missions and potential satellite programs. Finally, the various existing methods for the detection of coal fires are summarized in a tabular form and their effectiveness compared. Dissert. Abstr.

N73-22385 West Virginia Univ., Morgantown.
INTENSITY RELATIONS AND SATELLITE STUDIES IN THE SPECTRA RESULTING FROM ALKALI/FOREIGN GAS INTERACTIONS Ph.D. Thesis
Reginald John Exton 1972 129 p
Avail: Univ. Microfilms Order No. 72-26864

A multiple pass absorption cell was employed in alkali-foreign gas studies in which the aklali distribution along the cell is determined via transverse measurements. It was found that the diffusion of alkali vapors is restricted more than was suspected, as the vapors are confined in a fog-like manner to the regions immediately above the alkali metal source. Relative oscillator strengths were measured for the principal series doublets of cesium and rubidium using the actual vapor path lengths as determined by the fog, and optically thin measurements of total line absorption. True line shapes (absorption coefficients) for several alkali-foreign gas combinations were measured using various vapor path lengths. The peak absorption coefficient of the red satellites on the resonance lines of rubidium perturbed by xenon was found to increase linearly with increasing number density of xenon. Dissert. Abstr.

N73-22386*# Massachusetts Inst. of Tech., Cambridge.
FAULT-TOLERANT CLOCK APPARATUS Patent Application
William M. Daly and John F. McKenna, Jr., inventors (to NASA) Filed 24 Apr. 1973 23 p Sponsored by NASA
(NASA-Case-MSC-12531-1; US-Patent-Appl-SN-354612) Avail: NTIS HC $3.25 CSCL 14B

A fault-tolerant clock apparatus is described which is insensitive to faults or failures in its own components. It provides an output clock pulse for use in fault-tolerant digital logic systems and directly related equipment. The apparatus is fault-tolerant in the sense that any single failure or number of failures will not affect the operation of the clock. NASA

N73-22387*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSTRUMENTATION FOR MEASUREMENT OF AIRCRAFT NOISE AND SONIC BOOM Patent Application
Allan J. Zuckerwar, inventor (to NASA) Filed 25 Apr. 1973 15 p
(NASA-Case-LAR-11173-1; US-Patent-Appl-SN-354408) Avail: NTIS HC $3.00 CSCL 14B

Instrumentation suitable for measuring both aircraft noise and sonic boom is described. It is comprised of a converter that produces an electric current proportional to the sound pressure level at a condenser microphone. The electric current is transmitted over a cable, amplified by a zero drive current amplifier, and recorded on a magnetic tape recorder. The converter consists of a local oscillator, a dual-gate field-effect transistor (FET) mixer, and a voltage regulator/impedance translator. The local oscillator generates a carrier voltage that is applied to one of the gates of the FET mixer. The mixer mixes the microphone signal with the carrier to produce an electrical current at the frequency of vibration of the microphone diaphragm. The voltage regulator/impedance translator regulates the voltage of the local oscillator and mixer stages, eliminates the carrier at the output, and provides a low output impedance at the cable terminals. Diagrams are included. NASA

N73-22388*# Honeywell, Inc., Lexington, Mass.
OPTICAL INSTRUMENTS Patent Application
Irving R. Abel, inventor (to NASA) Filed 10 Apr. 1972 13 p (Contract NAS9-11196)
(NASA-Case-MSC-14096-1; US-Patent-Appl-SN-242662) Avail: NTIS HC $3.00 CSCL 20F

A wide field, purely reflective, scanning optical system which scans a circular line or narrow band in the first image plane at a very high frequency is described. The system offers the following advantages: (1) It uses only reflective elements in order to cover a broad spectral region; (2) It uses image plane scanning to enable a high scan rate; (3) It has a relatively large radial scan angle for broad area coverage to allow rotational scan rather than oscillatery scan, thereby producing a high scan rate; (4) It has a very large polar scan angle for large area coverage; (5) A large aperture is employed with a low f-number; (6) A relatively simple configuration of plane and spherical mirrors is used with one aspherical mirror; (7) Two small mirrors, fixed one to the other, are the only movable optical elements. NASA

N73-22389*# McDonnell Aircraft Co., St. Louis, Mo.
IMAGE CORRELATION AND SAMPLING STUDY Final Report, Sep. 1971 - Jun. 1972
D. J. Popp, D. S. McCormack, and J. L. Sedwick Jun. 1972 196 p refs
(Contract NAS5-21662)
(NASA-CR-130223; MDC-A1740) Avail: NTIS HC$12.00 CSCL 14E

The development of analytical approaches for solving image correlation and image sampling of multispectral data is discussed. Relevant multispectral image statistics which are applicable to image correlation and sampling are identified. The general image statistics include intensity mean, variance, amplitude histogram, power spectral density function, and autocorrelation function. The translation problem associated with digital image registration and the analytical means for comparing commonly used correlation techniques are considered. General expressions for determining the reconstruction error for specific image sampling strategies are developed. Author

N73-22390# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
INFRARED FOURIER SPECTROSCOPY APPLIED TO THE MEASUREMENT OF AIRCRAFT SPECTRA
M. W. Slack Apr. 1973 26 p refs
(RM-572) Avail: NTIS HC $3.50

Fourier spectroscopy has been used to obtain infrared spectra from a number of aircraft, including an OV-1D Mohawk, and F-14, and a UH1. This memorandum presents performance specifications of the instrumentation together with a description of data reduction techniques and examples of measured IR spectra. Author

N73-22391# National Bureau of Standards, Washington, D.C. Heat Div.
AN INVESTIGATION OF THE STABILITY OF AND INSULATION LEAKAGE IN SOME HIGH TEMPERATURE RESISTANCE THERMOMETERS Interim Report, 1 Jan. - 31 Dec. 1972
Sharrill D. Wood May 1973 31 p refs
(NBS-TN-764) Avail: SOD HC $0.50 Domestic Postpaid or $0.35 GPO Bookstore as C13.46:764

Data are presented concerning the stability of high temperature resistance thermometers. Two types of platinum and one type of tungsten thermometer were tested are 1065 C and 960 C. Some of the platinum thermometers were also tested at 900 C and at the freezing point of zinc. Results of tests are also given on the insulation resistance of sensor supports and lead assemblies for the two types of platinum thermometers. A new design for a zinc-point cell is briefly discussed. Suggestions for future work are indicated. Author

N73-22392*# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Div.
PROBLEMS AFFECTING THE FIDELITY OF PRESSURE MEASURING INSTRUMENTS FOR PLANETARY PROBES Final Report, 1 Sep. 1966 - 31 Aug. 1972
John B. Hudson Nov. 1972 387 p refs
(Grant NGL-33-018-066)
(NASA-CR-112320) Avail: NTIS HC $21.50 CSCL 14B

Determination is made of the nature and magnitude of surface-related effects that cause errors in pressure measuring instruments, with special reference being made to instruments intended for use in planetary probes. The interaction of gases with clean surfaces of metals likely to be used as gage construction materials was studied. Special emphasis was placed on the adsorption, chemical reaction, and electron-induced desorption processes. The results indicated that all metals tested were subject to surface processes which would degrade gage fidelity. It was also found, however, that the formation of inert adsorbed layers on these metal surfaces, such as carbon on platinum, greatly reduced or eliminated these effects. This process, combined with a system design which avoids contact between reactive gases and hot filaments, appears to offer the most promising solution to the gage fidelity problem. Author

N73-22393*# Louisiana State Univ., Baton Rouge. Mechanical, Aerospace, and Industrial Engineering Dept.
DESIGN AND CONSTRUCTION OF A REMOTE SENSING APPARATUS Final Report
Dupree Maples and John F. Hagewood [1973] 34 p
(Grant NGL-19-001-068)
(NASA-CR-124219) Avail: NTIS HC $3.75 CSCL 14B

The methods of identifying plant and soil types using remote sensing techniques are described. The equipment employed consists of a balloon system and a mobile remote sensing laboratory housing a radiometer which is mounted on a turret mechanism. The radiometer is made up of a telescope whose lenses are replaced by mirrors which channel received radiation into a monochromator. The radiation is then focused onto detectors for measurement of the intensity of the electromagnetic energy as a function of wavelength. Measurements from a wavelength of 0.2 microns to 15 microns are obtained with the system. diagrams are provided. J.M.M.

N73-22394*# Kollsman Instrument Corp., Syosset, N.Y.
SCIENTIFIC INSTRUMENT PACKAGE FOR THE LARGE SPACE TELESCOPE (SIP) Final Project Summary Technical

Report
Dec. 1972 37 p
(Contract NAS5-23068)
(NASA-CR-130214) Avail: NTIS HC $4.00 CSCL 20F

The feasibility of a scientific instrument package (SIP) that will satisfy the requirements of the large space telescope was established. A reference configuration serving as a study model and data which will aid in the trade-off studies leading to the final design configuration are reported. Author

N73-22395*# Purdue Univ., Lafayette, Ind.
USE OF SCAN OVERLAP REDUNDANCY TO ENHANCE MULTISPECTRAL AIRCRAFT SCANNER DATA Lab. for Applications of Remote Sensing.
J. C. Lindenlaub and J. Keat 1973 25 p refs
(Grant NGR-15-005-112)
(NASA-CR-131587; LARS-Inform-Note-120271) Avail: NTIS HC $3.25 CSCL 20F

Two criteria were suggested for optimizing the resolution error versus signal-to-noise-ratio tradeoff. The first criterion uses equal weighting coefficients and chooses n, the number of lines averaged, so as to make the average resolution error equal to the noise error. The second criterion adjusts both the number and relative sizes of the weighting coefficients so as to minimize the total error (resolution error plus noise error). The optimum set of coefficients depends upon the geometry of the resolution element, the number of redundant scan lines, the scan line increment, and the original signal-to-noise ratio of the channel. Programs were developed to find the optimum number and relative weights of the averaging coefficients. A working definition of signal-to-noise ratio was given and used to try line averaging on a typical set of data. Line averaging was evaluated only with respect to its effect on classification accuracy. Author

N73-22396*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
THE 60 GHz RADIOMETRIC LOCAL VERTICAL SENSOR EXPERIMENT
C. Herbert Grauling, Jr. Washington NASA Apr. 1973 207 p refs
(Contract NAS1-10131)
(NASA-CR-2229) Avail: NTIS HC $3.00 CSCL 14B

The experiment concept involves the use of millimeter wave radiation the atmospheric oxygen to provide vertical sensing information to a satellite-borne radiometer. The radiance profile studies require the calculation of ray brightness temperature as a function of tangential altitude and atmosphere model, and the computer program developed for this purpose is discussed. Detailed calculations have been made for a total of 12 atmosphere models, including some showing severe warning conditions. The experiment system analysis investigates the effect of various design choices on system behavior. Calculated temperature profiles are presented for a wide variety of frequencies, bandwidths, and atmosphere models. System performance is determined by the convolution of the brightness temperature and an assumed antenna pattern. A compensation scheme to account for different plateau temperatures is developed and demonstrated. The millimeter wave components developed for the local vertical sensor are discussed, with emphasis on the antenna, low noise mixer, and solid state local oscillator. It was concluded that a viable sensing technique exists, useful over a wide range of altitude with an accuracy generally on the order of 0.01 degree or better. Author

N73-22397# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPURIOUS FORCES IN AN ELECTROSTATIC SUSPENSION
Jean-Louis Boulay and Jean Maulard 1972 58 p refs In FRENCH; ENGLISH summary
(ONERA-NT-197) Avail: NTIS HC $5.00

The development of ultrasensitive accelerometers used in spacecraft entailed the study of the very weak spurious forces acting on the proof mass of these instruments, in particular those of electrostatic origin. The latter are due either to random distributions of electronic output actions on the surfaces of the proof mass and of the accelerometer cage, or to electrostatic charges created on the proof mass by Volta effect during contact with the cage. These phenomena are described and analyses were made of the measurements in view of the fluctuations of the output actions and the values of the charges on the metals making up the detecting elements of the accelerometers. Author

N73-22398*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SCINTILLATOR HANDBOOK WITH EMPHASIS ON CESIUM IODIDE
John L. Tidd, Joseph R. Dabbs, and Norman Levine 13 Apr. 1973 92 p refs
(NASA-TM-X-64741) Avail: NTIS HC $6.75 CSCL 14B

This report provides a background of reasonable depth and reference material on scintillators in general. Particular attention is paid to the cesium iodide scintillators as used in the High Energy Astronomy Observatory (HEAO) experiments. It is intended especially for use by persons such as laboratory test personnel who need to obtain a working knowledge of these materials and their characteristics in a short time. Author

N73-22399# Louvain Univ. (Belgium). Inst. of Mechanical Manufacturing.
MANUFACTURE AND QUALIFICATION OF GLAZED GRINDING WHEELS [FABRICATION ET QUALIFICATION DES MEULES VITRIFIEES]
M. Moser (Budapest Tech. Univ.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Nov. 1972 103 p refs In FRENCH
(CRIF-MC-45) Avail: NTIS HC $7.25

The principles governing the operations of a grinding wheel are presented. Mechanical properties and the chemical composition of various abrasive materials such as aluminum compounds, artificial carborundum, silicon carbide, bauxite, and zirconium oxide are reviewed. Abrasives are discussed, as well as some control methods for abrasive microhardness. Ceramic agglomerate composition and mechanical properties are outlined, and inspection methods, including X-ray diffraction, dilatometry, and heating microscopy are reviewed. Variation of the microhardness of carborundum/boundary layer/ceramic agglomerate was analyzed, and the relationship between the abrasive, the agglomerate, and the porosity, is discussed. The grinding chemistry was studied and illustrated by titanium grinding using carborundum or carborundum grinding wheels. ESRO

N73-22400# Royal Aircraft Establishment, Farnborough (England).
A SEISMIC ANGULAR VIBRATION TRANSDUCER EMPLOYING AS GAS ROTOR
W. R. MacDonald and P. W. Cole Apr. 1972 31 p refs
(RAE-TM-IR-128; BR-29484) Avail: NTIS HC $3.75

A angular vibration transducer in which a helical column of gas constitutes the seismic rotary mass is described. The design of a transducer of range plus or minus 10 deg covering the frequency band from 2 to 20 Hz discussed, and results of performance tests on the instrument are given. In contrast to other instruments of its type, this has an inbuilt perfection of balance which makes it immune to linear acceleration, and its dynamic response is stable over a wide range of temperature due to the stable characteristics of gas dampings. ESRO

N73-22401# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
FAST TESTING OF GRINDING WHEEL HARDNESS [CONTROLE RAPIDE DE LA DURETE DES MUELES]
Albert Decneut and Richard Aerens Jan. 1973 23 p refs In FRENCH
(CRIF-NT-9) Avail: NTIS HC $3.25

A fast and nondestructive method for grinding wheel hardness control was described. The method, based on the calculation of grinding wheel modulus of elasticity, was determined from measurements of the vibration natural frequency. Form factor tables for simplified calculation of Young's modulus were used. The use of a small computer for the storage of form factors allows the automatic calculation of the modulus of elasticity. ESRO

N73-22402# Saab-Scania, Linkoping (Sweden).
STUDY OF PASSIVE MICROWAVE RADIOMETRY AND ITS POTENTIAL APPLICATIONS TO EARTH RESOURCES

SURVEYS
E. Ohlsson Paris ESRO Sep. 1972 89 p refs
(Contract ESTEC-1411/71)
(ESRO-CR-116) Avail: NTIS HC $6.50

The results of a 9 month study on passive microwave radiometry applied to earth resources surveys are summarized. Activities reported are studies on physical background, material properties, technological implementation, potential applications, and data analysis. An inventory of activities in microwave radiometry in the USA and in Europe was made. The technological studies and identified applications have formed the background for recommendations on a development, evaluation, and application program in Europe. Author (ESRO)

N73-22403# Plessey Co., Ltd., Havant (England).
MULTISPECTRAL SCANNING SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH RESOURCE SURVEYS. VOLUME 1: BASIC PHYSICS AND TECHNOLOGY
A. D. Higham, B. Wilkinson, and D. Kahn Dec. 1972 201 p refs 7 Vol.
(Contract ESTEC-1673/72-EL)
(ERL/R-243-U; ESRO-CR(P)-231) Avail: NTIS HC $12.25

The basic physics of the multispectral sensing process in earth resources surveys are considered, and the sensor techniques necessary to extract useful information are discussed. The sources of radiant energy, effects of the atmosphere, and the radiation/matter interactions, giving rise to useful information, are discussed. The sensing platform, scanning techniques, wavelength selection methods, and detectors are considered, and MSS instruments are described. ESRO

N73-22404# Plessey Co., Ltd., Havant (England). Electronics Research Lab.
MULTISPECTRAL SCANNING SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH RESOURCE SURVEYS. VOLUME 2: SPECTRAL PROPERTIES OF MATERIALS
E. Fitzgerald Dec. 1972 257 p refs 7 Vol.
(Contract ESTEC-1673/72-EL)
(ERL/R-244-U; ESRO-CR(P)-232) Avail: NTIS HC $15.00

The spectral properties in the visible and infrared spectrum of common earth materials such as vegetation, soils, water, minerals, and man-made materials are described. The properties discussed are those of use, or likely to be of use, in the analysis and interpretation of data collected during earth resource surveys from remote platforms. Changes in these properties resulting from variations in the composition and structure of the materials, and variations in the materials' physical environment, are discussed. Author (ESRO)

N73-22405# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
APPLICATIONS OF THE LAWRENCE CORROSION DETECTION GAUGE (CDG-2)
Philip Fischer 5 Dec. 1972 19 p refs
(AD-755163; NADC-72251-VT) Avail: NTIS CSCL 11/6

Tests were conducted to explore the use of the Lawrence Corrosion Detection Gauge (CDG-2) as an auxiliary tool in new applications areas in the Analytical Rework Program. Calibration data are presented showing the reproducibility of measurements made by the instrument. Tentative procedures for the determination of corrosion resistant properties of coatings on low alloy steel and susceptibility to exfoliation of 7178 aluminum alloy T6 and T76 tempers are described and data are given. Author (GRA)

N73-22406# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGHLY SENSITIVE MODULATION RADIOMETER ON THE 3.5 CM WAVELENGTH
A. E. Andrivevskii, A. G. Gorshkov, V. V. Danilov, V. K. Konnikova, A. S. Lobarev, V. G. Mirovskiy, V. V. Nikitin, V. I. Portman, Ye. Ye. Spangenberg, I. A. Strukov et al 13 Feb. 1973 33 p refs Transl. into ENGLISH of Acad. of Sci. (USSR), Inst. of Space Res., Moscow, Preprint 52, 1971 p 1-26
(AF Proj. 3901)
(AD-756563; FTD-MT-24-47-73) Avail: NTIS CSCL 14/2

The following topics are discussed: Input circuits of the radiometer; Modulator; Calibrating device; High-frequency amplification unit; Parametric amplifier unit; Pumping circuit; Tunnel amplifier unit; Detector; Operational characteristics of the radiometer. GRA

N73-22407# Army Foreign Science and Technology Center, Charlottesville, Va.
VOLT-AMPERE CHARACTERISTICS OF THERMOELECTRIC INDICATORS OF MICROWAVE EMISSION
A. I. Satyukov 29 Dec. 1972 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev), v. 14, Jan. 1971 p 94-98
(AD-756561; FSTC-HT-23-1281-72) Avail: NTIS CSCL 17/5

Effect of charge carrier heating on the volt-ampere characteristics (VAC) of thermoelectric indicators with the electron-electron transits of a small area is examined. Computation of the VAC and of the device resistance is presented, taking into account carrier heating in the small signal mode. Results of the experimental investigation of the thermoelectric indicators VAC are presented. Author (GRA)

N73-22408# Defense Documentation Center, Alexandria, Va.
HOLOGRAPHY Report Bibliography, Jan. 1970 - Sep. 1972
Mar. 1973 202 p refs
(AD-756600; DDC-TAS-73-2) Avail: NTIS CSCL 14/5

The bibliography contains unclassified and unlimited reports on Holography. Author (GRA)

N73-22409# Transport and Road Research Lab., Crowthorne (England).
REPLICA TECHNIQUES FOR THE STUDY OF ROADSTONES BY SCANNING ELECTRON MICROSCOPY
Gwen Neville 1972 28 p refs
(PB-212720; TRRL-LR-445) Avail: NTIS HC $3.00 CSCL 13B

An account is given of a positive replica technique which has been developed for studying the polishing of road surfacing aggregates by scanning electron microscopy. The technique allows the continuous nondestructive observation of roadstones 'in situ' in the road surface at magnifications up to 5,000. The techniques is currently being used in the Laboratory's research into the polishing mechanism of roadstones and could also be of value in many other fields of research. Author (GRA)

N73-22410# Diax Corp., La Jolla, Calif.
BOREHOLE DEPLOYMENT OF BROADBAND QUARTZ TORSIONAL ACCELEROMETERS Final Report, 17 Apr. - 30 Nov. 1972
Barry Block, Bruce Bartholomew, Jay Dratler, Jr., and Crispin Hollinshead 30 Nov. 1972 66 p refs
(Contract F44620-72-C-0087; ARPA Order 2183)
(AD-755852; AFOSR-73-0263TR) Avail: NTIS CSCL 14/2

The DIAX torsional accelerometers have been repackaged for borehole use. The basic sonde system is presently designed to operate at a pressure equivalent to a depth of 3000 feet of water. It should be noted that the DIAX accelerometers provide true broadband information which extends from zero frequency to several Hertz. This enables the following phenomena to be investigated with a single system at no additional cost: High frequency seismic signals (6 to 0.1 seconds period); Low frequency seismic signals (60 to 6 seconds period); Earth normal mode excitations (3600 to 60 seconds period); Tectonic phenomena at nearly zero frequency. The DIAX system is the only system with low noise, low drift and high sensitivity over this entire bandwidth. Operation at depth will allow isolation from surface noise sources yielding excellent quality data independent of local surface weather conditions. Author (GRA)

N73-22411# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
A METHOD FOR PRODUCING QUANTITATIVELY BASED MILITARY GEOGRAPHIC INTELLIGENCE PRODUCTS FOR AN AIRMOBILE DIVISION Final Report
Joseph L. Decell, Warren E. Grabau, Bob O. Benn, Jack K. Stoll, and Beryl G. Stinson Jul. 1972 84 p refs
(AD-756191; AEWES-Misc-Paper-M-72-6) Avail: NTIS CSCL 15/4

Seven prototype military geographic intelligence (MGI)

products, specifically designed to meet the terrain intelligence needs of an airmobile division in a tactical situation, were developed. The development included five steps: compilation of conceptual models relating the terrain to certain tactical activities; identification of significant terrain factors and assignment of class ranges of their values on the basis of the requirements of the models; construction of factor maps of the selected study area on the basis of the selected terrain factor classes; compilation of a factor complex map for each desired MGI product; and transformation of the factor complex maps to performance prediction maps, which were the desired end product. Author (GRA)

N73-22412# ADCOLE Corp., Waltham, Mass.
ELECTRONIC INSTRUMENTATION FOR SOLAR RADIATION MEASUREMENTS Final Report, 16 Sep. 1971 - 15 Sep. 1972
Emilio A. Zeuli 31 Oct. 1972 53 p refs
(Contract F19628-72-C-0053; AF Proj. 6688)
(AD-756909; AFCRL-72-0635) Avail: NTIS CSCL 14/2

The report describes the modification of the electronic portions of a double-deck extreme ultraviolet spectrophotometer recovered from a previous rocket flight, and the pre-flight tests and launch of two rocket instruments for the investigation of solar extreme ultraviolet radiation. A retarding potential analyzer used for analysis of environmental charged particles was flown on one instrument as an auxiliary experiment. Associated equipment used for calibration and testing of the instruments in both the laboratory and pre-launch phases is described. Experiments were flown on Aerobee 170 and Black Brant V rockets. Author (GRA)

N73-22413# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF OPTICAL PROPERTIES ON NATURAL OBJECTS AND THEIR AERIAL PHOTOGRAPHIC IMAGE FORMATION
Yu. K. Yutsenich 8 Dec. 1972 249 p refs Transl. into ENGLISH of the book "Issled. Optich. Svoistv Prirodn. ob Ektov i ikh Aerogotografiches" Leningrad, 1970 169 P
(AD-756603; FSTC-HT-23-1757-72) Avail: NTIS CSCL 14/5

A critical survey is given of studies conducted on optical parameters of natural formations. The author has shown that for purposes of aerial photography, the optical properties of natural formations can describe with adequate completeness their spectral coefficients of brightness (SCB). Data are given on the accuracy of determining the SCB of natural formations necessary for the contemporary state of art of aerial photography. The author examines the factors modifying the SCB values of natural formations. A survey is given of the instruments, plus an analysis of their suitability for determining the SCB under natural conditions. A conclusion is made to the effect that at the present time, the extent of our knowledge concerning the optical properties of natural formations is inadequate both from quantitative and geographic standpoints; the data available on the SCB lack the necessary generality. Recommendations are given on improving the study of optical parameters of natural formations. GRA

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-22414 Houston Univ., Tex.
THE EFFECT OF TENSION ON THE DYNAMIC BEHAVIOR OF ECCENTRIC SHAFTS ROTATING IN FLUID MEDIUM Ph.D. Thesis
Victor Prodonoff 1972 134 p
Avail: Univ. Microfilms Order No. 72-27514

Using Euler-Bernoulli beam theory, an investigation was made of the dynamic behavior of an eccentric rotating shaft, subject to linearly varying or constant tension. The shaft has distributed mass and elasticity and is suspended in a fluid. Initial lack of straightness was also included in the analysis. The local mass eccentricity is assumed to be a deterministic function of the axial coordinate. For the variable tension case the response was determined for a vertical shaft simply supported at the top and vertically guided at the bottom. The constant tension case was analyzed for a shaft simply supported at its ends. The solution was obtained using modal analysis. It is in series form and is expressed in terms of characteristic functions of the free vibration shaft. Results are given in graphical form for several values of the tension and different eccentricity functions. Dissert. Abstr.

N73-22415*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSULATION FOIL AND METHOD OF MAKING Patent Application
Edward A. Maslowski, inventors (to NASA) Filed 2 May 1973 10 p
(NASA-Case-LEW-11484-1; US-Patent-Appl-SN-356554) Avail: NTIS HC $3.00 CSCL 13H

An insulating foil particularly adapted for use in a multilayer insulation system is disclosed together with a method of insulation. A molten ceramic material such as a refractory oxide is deposited on a plurality of spots on a metal foil to produce protuberances having a ceramic coating. This may be accomplished by plasma spraying the material through an apertured mask placed against the foil. The foil may be in the form of a continuous strip which is advanced to a new position after each flame spraying operation. A cooled backing plate may be disposed against the foil to control the temperature. Hydraulic actuating means may be utilized to actuate the apertured mask to clamp the foil between the mask and the backing plate prior to each flame spraying operation. NASA

N73-22416*# Sperry Rand Corp., Charlottesville, Va. Marine Systems Div.
IRONLESS ARMATURE TORQUE MOTOR Final Report, Jul. 1971 - Jul. 1972
R. L. Fisher 10 Sep. 1972 59 p
(Contract NAS5-11481)
(NASA-CR-130224; JA-700-0020) Avail: NTIS HC $5.00 CSCL 09C

Four iron-less armature torque motors, four Hall device position sensor assemblies, and two test fixtures were fabricated. The design approach utilized samarium cobalt permanent magnets, a large airgap, and a three-phase winding in a stationary ironless armature. Hall devices were employed to sense rotor position. An ironless armature torque motor having an outer diameter of 4.25 inches was developed to produce a torque constant of 65 ounce-inches per ampere with a resistance of 20.5 ohms. The total weight, including structural elements, was 1.58 pounds. Test results indicated that all specifications were met except for generated voltage waveform. It is recommended that investigations be made concerning the generated voltage waveform to determine if it may be improved. Author

N73-22417*# McDonnell-Douglas Corp., St. Louis, Mo.
LATCHING DEVICE Patent Application
George Ulrich, inventor (to NASA) Filed 2 May 1973 16 p
Sponsored by NASA
(NASA-Case-MFS-21606-1; US-Patent-Appl-SN-356555) Avail: NTIS HC $3.00 CSCL 13E

An improved latching device for joining structural components in a substantially motionless relationship is described. The latch includes a receiver in a latching mechanism movable into juxtaposition with the receiver. The latching mechanism includes a pivotally supported restraining hook continuously biased in a direction for capturing the receiver. The hook further includes a springbiased ratchet pawl comprising a pivoted tongue for engaging a shoulder depending from the receiver for the coupling of the hook and receiver. Additionally, there is a ball-and-detent coupling having engageable spherical and conical surfaces for prohibiting the movement of the latching mechanism relative to the receiver. NASA

N73-22418# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
SOME EXPERIMENTS ON THE STIRRING OF VISCOUS LIQUIDS Final Report

Albert Napolitano May 1973 60 p
Contract AF 33(038)49-4393
(NBS-TN-771) Avail: SOD HC $0.85 domestic postpaid or $0.60 GPO Bookstore as C13.46:771

The stirring actions of several designs of small stirrers were observed and photographed in transparent viscous model liquids. The fluidity of the liquids was comparable to that of a molten borosilicate glass at fining temperatures. The most efficient features of one or more of these stirrers were incorporated into larger model stirrers and observed under actual stirring conditions. As a result of these performance tests, a final design of stirrer was selected and fabricated of platinum-rhodium metal and used in an experimental glass tank. The design of one of the pots in the experimental glass tank was modified to obtain the maximum stirring action with the selected stirrer. Author

N73-22419*# Texas Instruments, Inc., Dallas. Equipment Group.
ESTABLISHMENT OF QUALITY, RELIABILITY AND DESIGN STANDARDS FOR LOW, MEDIUM, AND HIGH POWER MICROWAVE HYBRID MICROCIRCUITS Final Report
Eugene A. Robinson Feb. 1973 145 p refs
(Contract NAS8-25616)
(NASA-CR-124211; U1-842630-F) Avail: NTIS HC $9.25 CSCL 14D

Quality, reliability, and design standards for microwave hybrid microcircuits were established. The MSFC Standard 85M03926 for hybrid microcircuits was reviewed and modifications were generated for use with microwave hybrid microcircuits. The results for reliability tests of microwave thin film capacitors, transistors, and microwave circuits are presented. Twenty-two microwave receivers were tested for 13,500 unit hours. The result of 111,121 module burn-in and operating hours for an integrated solid state transceiver module is reported. Author

N73-22420*# Solar, San Diego, Calif.
BRAZING OF BERYLLIUM FOR STRUCTURAL APPLICATIONS Final Report
J. W. Vogan [1972] 31 p
(Contract NAS8-28029)
(NASA-CR-124228; Solar-RDR-1723-2) Avail: NTIS HC $3.75 CSCL 13H

Progress made in fabricating a beryllium compression tube structure and a stiffened beryllium panel. The compression tube was 7.6cm in diameter and 30.5cm long with titanium end fittings. The panel was 203cm long and stiffened with longitudinal stringers. Both units were assembled by brazing with BAg-18 braze alloy. The detail parts were fabricated by hot forming 0.305cm beryllium sheet and the brazing parameters established. Author

N73-22421# Defence Standards Labs., Maribyrnong (Australia).
SOME EXPERIMENTS ON THE EXPLOSIVE WELDING OF METALS
J. J. Batten, P. C. Hughes, D. C. Murdie, and R. H. Phillips Dec. 1972 37 p refs
(TN-279) Avail: NTIS HC $4.00

A method of bonding sheets of aluminum alloys to sheets of steel to form a high strength composite is described. It was found that strong bonds can be produced between various aluminum alloys and themselves (and also between copper and itself) by the explosive welding process, and that the weld interface could have a characteristic wavy form. However, no strong weld could be produced between the aluminum alloys and mild steel sheets. The work supported the various theories that have been advanced to explain the process of explosive welding, namely, that the explosive most likely to produce a satisfactory joint between various metals needs to have a velocity of detonation similar to the velocity of sound in the metals being joined. Author

N73-22422*# DCA Reliability Lab., Inc., Mountain View, Calif.
EXTENDED LIFE TESTING EVALUATION OF COMPLEMENTARY MOS INTEGRATED CIRCUITS Final Report, Mar. 1971 - May 1972
Thomas E. Brosnan 7 Jul. 1972 103 p
(Contract NAS8-25897)
(NASA-CR-124215; DCA-FR-203) Avail: NTIS HC $7.25 CSCL 14D

The purpose of the extended life testing evaluation of complementary MOS integrated circuits was twofold: (1) To ascertain the long life capability of complementary MOS devices. (2) To assess the objectivity and reliability of various accelerated life test methods as an indication or prediction tool. In addition, the determination of a suitable life test sequence for these devices was of importance. Conclusions reached based on the parts tested and the test results obtained was that the devices were not acceptable. Author

N73-22423*# Sealol, Inc., Providence, R.I.
DEVELOPMENT OF WELDED METAL BELLOWS HAVING MINIMUM EFFECTIVE DIAMETER CHANGE Final Technical Report
J. K. Henschel, J. B. Stevens, A. C. Harvey (Foster-Miller Assoc., Inc.), J. S. Howland (Foster-Miller Assoc., Inc.), and S. S. Rhee (Foster-Miller Assoc., Inc.) Nov. 1972 163 p refs Prepared in cooperation with Foster-Miller Assoc., Inc.
(Contract NAS3-12004)
(NASA-CR-121117) Avail: NTIS HC $10.25 CSCL 13I

A program of analysis, design, and fabrication was conducted to develop welded metal bellows having a minimum change in effective diameter for cryogenic turbomachinery face seal applications. Linear analysis of the principle types of bellows provided identification of concepts capable of meeting basic operation requirements. For the 6-inch (.152 m) mean diameter, 1.5-inch free length bellows studied, nonlinear analysis showed that opposed and nested toroidal bellows plates stiffened by means of alternating stiffener rings were capable of maintaining constant effective diameter within 0.3% and 0.1% respectively under the operating conditions of interest. Changes in effective diameter were due principally to bellows axial deflection with pressure differential having a lesser influence. Fabrication problems associated with joining the thin bellows plates to the relatively heavy stiffener rings were encountered and precluded assembly and testing of a bellows core. Fabrication problems are summarized and recommended fabrication methods for future effort are presented. Author

N73-22424# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BRAKE CLEARANCE CONTROLLING MECHANISM
A. M. Argunov, I. I. Zverev, and A. I. Bakin 30 Mar. 1972 5 p Transl. into ENGLISH of USSR Patent No. 264856 (Appl. No. 1286919/25-27, 29 Nov. 1968), 1970 p 1-2
(AD-742704; FTD-HT-23-370-72) Avail: NTIS HC $3.00 CSCL 13/6

There is a split bush screwed into the body, the components of which serve as springing elements. The bracing bush is fixed inside the split bush. This improves reliability and simplifies assembly. These brakes are used in cars and airplanes. When working fluid is supplied to the executive mechanisms, a disk moves. At the moment of debraking, the return springs push the pressure disk back. Thus as the friction material wears, clearance B between the disc and pack of disks increases from constant A to A plus C, where C is the width of the rod comb. Then the elements jump to the next notch of the rod, and the clearance again increases to the required value. Author

N73-22425# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRODYNAMIC EFFECT OF A LUBRICANT WITH REVERSE EXTRUSION
N. A. Koryakin, V. I. Kazachenok, and I. B. Pokras 12 Apr. 1972 5 p refs Transl. into ENGLISH from Issled Protessov Obrab. Metal. Davleniem (Izhevsk), no. 3, 1969 p 28-35
(AD-743242; FTD-HC-23-255-72) Avail: NTIS HC $3.00 CSCL 11H

It was established on the basis of an experimental investigation of the effect of viscous lubricants on metal flow in the reverse squeezing, that closing of continuous lubricant layer above the punch, due to the hydrodynamic effect of the lubricant and to continuous lubricant displacement and expenditure in squeezing, sharply reduces the contact friction and specific pressure. It also equalizes deformations and improves the durability of dies. Author

N73-22426*# Little (Arthur D.), Inc., Cambridge, Mass.
PLATING METHODS, A SURVEY

Joan B. Berkowitz and Newton H. Emerson Washington NASA 1972 142 p refs Sponsored by NASA
(NASA-SP-5114; LC-72-600232) Avail: NTIS MF $0.95; SOD HC $1.00 domestic postpaid or $0.75 GPO Bookstore CSCL 13H

Results are presented of a comprehensive search of the literature available, much of which has been generated by the research centers of NASA and its contractors, on plating and coating methods and techniques. Methods covered included: (1) electroplating from aqueous solutions; (2) electroplating from nonaqueous solutions; (3) electroplating from fused-salt baths; (4) electroforming; (5) electroless plating, immersion plating, and mirroring; (6) electroplating from gaseous plasmas; and (7) anodized films and conversion coatings. A.L.

N73-22427*# Mechanical Technology, Inc., Latham, N.Y.
EFFECTS OF VIBRATION AND SHOCK ON THE PERFORMANCE OF GAS-BEARING SPACE-POWER BRAYTON CYCLE TURBOMACHINERY. 2: SINUSOIDAL AND RANDOM VIBRATION
J. M. Tessarzik, T. Chiang, and R. H. Badgley Washington NASA Mar. 1973 266 p refs
(Contract NASw-1713)
(NASA-CR-2177; MTI-71TR66) Avail: NTIS HC $3.00 CSCL 13I

The vibration response of a gas-bearing rotor-support system was analyzed and experimentally documented for sinusoidal and random vibration environments. The NASA Brayton Rotating Unit (BRU), 36,000 rpm; 10 KWe turbogenerator; was subjected in the laboratory to sinusoidal and random vibrations to evaluate the capability of the BRU to (1) survive the vibration levels expected to be encountered during periods of nonoperation and (2) operate satisfactorily (that is, without detrimental bearing surface contacts) at the vibration levels expected during normal BRU operation. Response power spectral density was calculated for specified input random excitation, with particular emphasis upon the dynamic motions of the thrust bearing runner and stator. A three-mass model with nonlinear representation of the engine isolator mounts was used to calculate axial rotor-bearing shock response. Author

N73-22428*# Mechanical Technology, Inc., Latham, N.Y.
EFFECTS OF VIBRATION AND SHOCK ON THE PERFORMANCE OF GAS-BEARING SPACE-POWER BRAYTON CYCLE TURBOMACHINERY. PART 3: SINUSOIDAL AND RANDOM VIBRATION DATA REDUCTION AND EVALUATION, AND RANDOM VIBRATION PROBABILITY ANALYSIS
J. M. Tessarzik, T. Chiang, and R. H. Badgley Jan. 1973 160 p refs
(Contract NAS3-15709)
(NASA-CR-121178; MTI-73TR4) Avail: NTIS HC $10.00 CSCL 13I

The random vibration response of a gas bearing rotor support system has been experimentally and analytically investigated in the amplitude and frequency domains. The NASA Brayton Rotating Unit (BRU), a 36,000 rpm, 10 KWe turbogenerator had previously been subjected in the laboratory to external random vibrations, and the response data recorded on magnetic tape. This data has now been experimentally analyzed for amplitude distribution and magnetic tape. This data has now been experimentally analyzed for amplitude distribution and frequency content. The results of the power spectral density analysis indicate strong vibration responses for the major rotor-bearing system components at frequencies which correspond closely to their resonant frequencies obtained under periodic vibration testing. The results of amplitude analysis indicate an increasing shift towards non-Gaussian distributions as the input level of external vibrations is raised. Analysis of axial random vibration response of the BRU was performed by using a linear three-mass model. Power spectral densities, the root-mean-square value of the thrust bearing surface contact were calculated for specified input random excitation. Author

N73-22429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE PRELIMINARY DESIGN OF BEARINGS FOR THE CONTROL SYSTEM OF A HIGH-TEMPERATURE LITHIUM-COOLED NUCLEAR REACTOR
H. G. Yacobucci, W. D. Waldron (Mech. Technol., Inc.), and J. A. Walowit (Mech. Technol., Inc.) Apr. 1973 68 p refs
(NASA-TM-X-68218; E-7415) Avail: NTIS HC $5.50 CSCL 13I

The design of bearings for the control system of a fast reactor concept is presented. The bearings are required to operate at temperatures up to 2200 F in one of two fluids, lithium or argon. Basic bearing types are the same regardless of the fluid. Crowned cylindrical journals were selected for radially loaded bearings and modified spherical bearings were selected for bearings under combined thrust and radial loads. Graphite and aluminum oxide are the materials selected for the argon atmosphere bearings while cermet compositions (carbides or nitrides bonded with refractory metals) were selected for the lithium lubricated bearings. Mounting of components is by shrink fit or by axial clamping utilizing differential thermal expansion. Author

N73-22430*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-ACTING AND HYDRODYNAMIC SHAFT SEALS
Lawrence P. Ludwig 1973 40 p refs Presented at Seal Educ. Course of the Ann. Meeting of the Am. Soc. of Lubrication Engr., Chicago, 30 Apr. - 3 May 1973
(NASA-TM-X-68214; E-7406) Avail: NTIS HC $4.00 CSCL 11A

Self-acting and hydrodynamic seals are described. The analytical procedures are outlined for obtaining a seal force balance and the operating film thickness. Particular attention is given to primary ring response (seal vibration) to rotating seat face runout. This response analysis revealed three different vibration modes. Proposed applications of self-acting seals in gas turbine engines and in rocket vehicle turbopumps are described. Also experimental data on self-acting face seals operating under simulated gas turbine conditions are given; these data show the feasibility of operating the seal at conditions of 345 newtons per square centimeter (500 psi) and 152 meters per second (500 ft/sec) sliding speed. Author

N73-22431*# Life Systems, Inc., Cleveland, Ohio.
EVALUATION OF AN ELECTROCHEMICAL N2/H2 GAS SEPARATOR Final Report
R. D. Marshall, R. A. Wynveen, and J. N. Carlson Mar. 1973 57 p refs
(Contract NAS2-7057)
(NASA-CR-114580; LSI-ER-168-8) Avail: NTIS HC $5.00 CSCL 13I

A program was successfully completed to evaluate an electrochemical nitrogen/hydrogen (N2/H2) separator for use in a spacecraft nitrogen (N2) generator. Based on the technical data obtained a N2/H2 separator subsystem consisting of an organic polymer gas permeator first stage and an electrochemical second and third stage was estimated to have the lowest total spared equivalent weight, 257 kg (566 lb), for a 15 lb/day N2 generation rate. A pre-design analysis of the electrochemical N2/H2 separator revealed that its use as a first stage resulted in too high a power requirement to be competitive with the organic polymer membrane and the palladium-silver membrane separation methods. As a result, program emphasis was placed on evaluating the electrochemical. A parametric test program characterized cell performance and established second- and third-stage electrochemical N2/H2 separator operating conditions. A design verification test was completed on the second and third stages. The second stage was then successfully endurance tested for 200 hours. Author

N73-22432# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY REPORT OF A MEDIUM SPEED MECHANISM
R. Barnick, G. Bracker, K. Ernsberger, M. Granzow, R. Hostenkamp, and H. Wohnhaas Nov. 1972 68 p
(Contract ESTEC-1566/72-CG)
(ESRO-CR(P)-226) Avail: NTIS HC $5.50

The design study of a despin mechanism is discussed, taking into account the bearing and lubrication system, off-loading mechanism, power/electrical signal transmission system, the motor, and the ground support equipment. In addition a detailed comparative thermal and stress analysis of two alternative

structural design approaches, one based on aluminum the other on beryllium, is described. ESRO

N73-22433# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY REPORT OF A MEDIUM SPEED MECHANISM APPENDIX 1-7
R. Barnick, G. Bracker, K. Ernsberger, M. Granzow, R. Hostenkamp, and H. Wohnhaas Nov. 1972 110 p refs
(Contract ESTEC-1566/72-KG)
(ESRO-CR(P)-227-App) Avail: NTIS HC $7.50

The analysis of alignment accuracy, lubrication system, off-load mechanism, load carrying capacity, thermal control and bearing system for the design study of a despin mechanism are discussed in detail. ESRO

N73-22434# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY REPORT OF A MEDIUM SPEED MECHANISM, APPENDIX 8-15
R. Barnick, G. Bracker, K. Ernsberger, M. Granzow, R. Hostenkamp, and H. Wohnhaas Nov. 1972 110 p
(Contract ESTEC-1566/72-KG)
(ESRO-CR(P)-228) Avail: NTIS HC $7.50

The angular stiffness, stress analysis, signal and power transmission, instrumentation and ground support equipment for the design study of a despin mechanism are discussed in detail. ESRO

N73-22435# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANIZED ARC WELDING OF JOINTS AND OF HARD FACES USING CERAMIC RODS
K. Wittke 22 Feb. 1973 10 p refs Transl. into ENGLISH from Schweisstechnik (East Berlin), no. 9, 1969 p 404-405
(FTD Proj. 60108)
(AD-756944; FTD-HC-23-1830-72) Avail: NTIS CSCL 13/8

The welding process is characterized by the separate feeding of the welding wire and of a longitudinally notched, ceramic rod. The process combines the advantages known for electric welding with the high melt-off rate of mechanical welding techniques. The present melt-off rate lies between that obtained in MIG- and in CO2- welding. Use of this process promises substantial economies. GRA

N73-22436# Battelle Columbus Labs., Long Beach, Calif. Ocean-Engineering Facility.
HELICOPTER-LOAD TENSION-MEMBER STUDY Final Report, 26 Jun. 1970 - 12 Apr. 1972
John C. Minor, Philip T. Gibson, and Hobart A. Cress Nov. 1972 170 p refs
(Contract DAAJ02-70-C-0064; DA Proj. 1F1-62203-A-254)
(AD-755532; USAAMRDL-TR-72-20) Avail: NTIS CSCL 13/9

The objectives of this program were to analyze technology applicable to tension members as it relates to the functional requirements of heavy outsized loads externally suspended from helicopters, and to develop a comprehensive design theory and conceptual designs for tension members which will provide a basis for future detail design, fabrication, and test programs. The tension-member concepts selected for study included wire rope, wire-rope belt, synthetic rope, synthetic tape, steel tape, roller chain, and jointed links. A weighted-parameter technique was used to begin evaluation of these candidate concepts, followed by an analysis of practical considerations with reference specifically to the 1972, 1975, and 1980 time frames. Author (GRA)

N73-22437# Army Construction Engineering Research Lab., Champaign, Ill.
THE INTRODUCTION OF DISCONTINUITIES IN HIGH STRENGTH STEEL WELDMENTS Preliminary Report
K. W. Carlson, F. V. Lawrence, Jr., and J. B. Radziminski Dec. 1972 13 p ref
(AD-755524; CERL-PR-M-27) Avail: NTIS CSCL 13/5

The objective of this study was to develop methods for consistently creating porosity, slag inclusions, lack of fusion, and hydrogen cross-cracking discontinuities in welds to evaluate their effects on the properties of welds. To accomplish this objective, weld deposition procedures were altered systematically to develop welding techniques capable of producing a specific discontinuity type and size. The techniques used included both electrical and mechanical perturbations of the welding parameters. It proved possible to implant weld discontinuities with good reproducibility. It was found, however, that mechanical perturbations were more reliable for accurate reproduction of discontinuities. Author (GRA)

N73-22438# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTACT INTERACTION OF SOLID BODIES AND CALCULATION OF THE FORCES OF FRICTION AND WEAR
10 Jan. 1973 375 p refs Transl. into ENGLISH of the book "Kontakt. Vzaimodeistvie Tverd. tel i Raschet sil Treniya i Iznosa" 1971 p 1-234
(AF Proj. 7343)
(AD-755710; FTD-HC-23-1009-72) Avail: NTIS CSCL 20/11

The collection reports the most recent research of Soviet and foreign scientists in the field of friction. A historical review of the development of the science of friction is given. The mechanism by which the rubbing surfaces interact is described. Problems of adhesive-bond strength, molecular bonds, local contacts between elastic bodies, calculation of contact interaction, wear, and friction forces are considered, as are problems of lubrication. Author (GRA)

N73-22439# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
THE INFLUENCE OF THE INTERFACE CONDITION ON THE PLASTIC DEFORMATION ZONE AND THE RESULTANT PRODUCT INTEGRITY IN EXTRUSION Technical Report, 1 Feb. 1971 - 15 Apr. 1972
F. J. Gurney and V. DePierre Oct. 1972 25 p refs
(Contract F33615-71-C-0063; AF Proj. 7351)
(AD-755832; AFML-TR-72-154) Avail: NTIS CSCL 13/8

The effect of the tooling-workpiece interface condition on the metal flow in extrusion is shown to be of critical importance in the achievement of sound product. For 2:1 reduction ratio extrusions, the central burst defect is shown to occur when low frictional restraint interfaces are employed. Sound internal product is shown to occur when high frictional restraint interfaces are employed. In metal alloy powder compaction-extrusion processes, a low density core is shown to be associated with compaction at low extrusion ratio employing low frictional restraint interfaces. The experimental results are discussed in terms of recent theoretical analyses of metalworking processes which are based on the effect of the interface friction influencing the volume of the plastic deformation zone and the subsequent strain rate fields. Author (GRA)

N73-22440# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WELDING METALS BY FRICTION
V. I. Vill 24 Oct. 1972 234 p refs Transl. into ENGLISH from the monograph "Svarka Metallov Treniem" USSR, 1960 p 1-176
(AD-755753; FTD-HC-23-736-72) Avail: NTIS CSCL 13/8

Contents: Features of friction welding; Mechanism of formation of a welded joint in solid phase; Basic information from the friction theory; Heat liberation during friction welding; Basic parameters and recommended regimes in friction welding process; Friction welding of parts made from similar metals; Friction welding of parts made from different metals and alloys; Quality control of friction welding joints; Friction welding equipment; Industrial use of friction welding. GRA

N73-22441# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING GAS FLOW IN A BYPASS COMPRESSOR
V. S. Salnilov 23 Jan. 1973 18 p Transl. into ENGLISH from Lopatochnye Mashiny i Struynye Apparaty (USSR), no. 5, 1971 p 45-54
(AD-756092; FTD-HT-23-1789-72) Avail: NTIS CSCL 13/7

The report discusses a calculation scheme for finding a number of solutions when designing a by-pass engine, where it is necessary to calculate also the flow in the compressor whose running section is divided into two annular channels by a longitudinal

semibarrier extending downstream from a certain intermediate stage. Author (GRA)

N73-22442# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
A COMPUTER PROGRAM FOR THE SPECIFICATION OF AXIAL COMPRESSOR AIR FOILS Final Report
George R. Frost, Richard M. Hearsey, and Arthur J. Wennerstrom Dec. 1972 171 p refs
(AF Proj. 7065)
(AD-756879; ARL-72-0171) Avail: NTIS CSCL 21/5

The report describes the analysis in, and the use of, a computer program which has been developed for use in the design of axial compressor airfoils suitable for operation at high subsonic and supersonic Mach numbers. Four rather versatile camber line shapes and two thickness distributions are mathematically derived. These camber lines provide the capability of defining a wide variety of blades, from those of continuously positive camber to the so-called S-blades, including many of the intermediate possibilities. A method is presented whereby the airfoils are specified on arbitrary axisymmetric streamsurfaces and then accurately redetermined in Cartesian coordinates on planes normal to the stacking axis. Author (GRA)

N73-22443# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROCEDURE FOR HARDENING WELD METAL DURING ITS FORMATION
U. T. Sultanov, B. V. Umarov, and M. A. Abralov 9 Feb. 1973 13 p ref Transl. into ENGLISH from Izv. Akad. Nauk Uzb. SSR, Ser. Tekhn. Nauk (Tashkent), no. 1, 1970 p 60-73
(AD-756335; FTD-HT-23-1749-72) Avail: NTIS CSCL 13/8

A procedure was developed for controlling the process of crystallization of metal in the molten pool. This procedure insures intensive influence, regulated within wide ranges, on the pool metal from the reverse side of weld, without direct contact with the latter. Structural analysis and mechanical tests showed that performing electromagnetic treatment during welding makes it possible to considerably refine the weld metal structure. Author (GRA)

N73-22918* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GALVANIC FORMING
L. C. Jackson *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 19-25 (For availability see N73-22915 13-34)
CSCL 13H

N73-22919* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VERSATILITY IN ELECTRON BEAM WELDING: A RATIONAL APPROACH
R. V. Hoppes *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 27-35 refs (For availability see N73-22915 13-34)
CSCL 13H

N73-22921* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APOLLO 14 COMPOSITE CASTING DEMONSTRATION
I. C. Yates *In its* Res. Achievement Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 45-66 (For availability see N73-22915 13-34)
CSCL 13H

N73-22922* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL STUDIES OF MANUFACTURING PROCESSES PERFORMED IN ZERO-G
Vaughn H. Yost *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 67-106 refs (For availability see N73-22915 13-34)
CSCL 13H

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-22444 Pennsylvania Univ., Philadelphia.
DUAL AXES PRECISION LASER BEAM DEFLECTION CONTROL SYSTEMS Ph.D. Thesis
Leonard Paul Dague 1972 94 p
Avail: Univ. Microfilms Order No. 72-25560

The problems involved in obtaining time base stability and intermachine compatibility in wideband laser recording systems are discussed. These problems are essentially fine control modifications of the coarse X and Y axis scanning produced by electro-mechanical means. A survey was made of possible fine control methods. This was followed by theoretical analysis and experimental tests of the most promising types of control elements and by the design of closed loop and quasi-closed loop control systems to implement the desired correlation. This research leads to the conclusion that at the present stage of rapid random access analog deflector development and considering the limitations of present technology, and acousto-optic type of deflector is the optimum solution for the particular applications studied. Dissert. Abstr.

N73-22445*# International Business Machines Corp., Gaithersburg, Md. Federal System Div.
LED PUMPED Nd:YAG LASER DEVELOPMENT PROGRAM Final Report
G. I. Farmer, Y. C. Kiang, and R. J. Lynch 16 Mar. 1973 118 p refs
(Contract NAS8-27563)
(NASA-CR-124225; FSC-73-5027) Avail: NTIS HC$8.00 CSCL 20E

The results of a development program for light emitting diode (LED) pumped Nd:YAG lasers are described. An index matching method to increase the coupling efficiency of the laser is described. A solid glass half-cylinder of 5.0 by 5.6 centimeters was used for index matching and also as a pumping cavity reflector. The laser rods were 1.5 by 56 millimeters with dielectric coatings on both end surfaces. The interfaces between the diode array, glass cylinder, and laser rod were filled with viscous fluid of refractive index n = 1.55. Experiments performed with both the glass cylinder and a gold coated stainless steel reflector of the same dimensions under the same operating conditions indicate that the index matching cylinder gave 159 to 200 percent improvement of coupling efficiency over the metal reflector at various operating temperatures. Author

N73-22446# Defence Standards Labs., Maribyrnong (Australia).
CONTINUOUS-WAVE CO2 LASER AT ATMOSPHERIC PRESSURE
R. McLeary and W. E. K. Gibbs Dec. 1972 5 p refs
(TM-50) Avail: NTIS HC $3.00

Continuous operation of an atmospheric-pressure CO2 laser has been achieved by use of a technique that prevents contraction of the electric discharge. Some performance characteristics are reported. Author

N73-22447# National Research Council of Canada, Ottawa (Ontario).
MEASUREMENT OF STRAIN IN A MATERIAL BY HOLOGRAPHIC INTERFEROMETRY
J. Tsujiuchi, N. Takeya, and K. Matsuda 1972 21 p refs Transl. into ENGLISH from Opt. Acta (England), v. 16, no. 6, 1969 p 709-722 (French language document)
(NRC-TT-1623) Avail: NTIS HC $3.25

The fringes of the holographic interferometer are studied for different types of movement of the object and the shape and the position of the fringes are obtained. From these studies it is shown that the illuminating beam of the object is parallel to the direction of observation and that the separation of fringes of equal inclination from those of equal thickness allows the measurement of circular displacement and lateral deformation. Author

N73-22448*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE APPLICATION OF LASER DOPPLER VELOCIMETRY TO TRAILING VORTEX DEFINITION AND ALLEVIATION
Kenneth L. Orloff and George R. Grant Feb. 1973 35 p refs
(NASA-TM-X-62243) Avail: NTIS HC $3.75 CSCL 20E

A laser Doppler velocimeter whose focal volume can be rapidly traversed through a flowfield has been used to overcome the problem introduced by excursions of the central vortex filament within a wind tunnel test section. The basic concepts of operation of the instrument are reviewed and data are presented which accurately define the trailing vortex from a square-tipped rectangular wing. Measured axial and tangential velocity distributions are given, both with and without a vortex dissipator panel installed at the wing tip. From the experimental data, circulation and vorticity distributions are obtained and the effect of turbulence injection into the vortex structure is discussed.
Author

N73-22449*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REVIEW OF LASER-SOLID INTERACTION AND ITS POSSIBILITIES FOR SPACE PROPULSION
K. G. Harstad 15 Nov. 1972 27 p refs
(Contract NAS7-100)
(NASA-CR-131744; JPL-TM-33-578) Avail: NTIS HC $3.50 CSCL 20E

Literature on laser-solid interaction is surveyed and the important regimes of this process are delineated. This information is used to discuss the possibility of a laser induced ablation thruster. It is concluded that such a thruster may be feasible if a sufficiently high intensity, high frequency laser beam is available and that further study of interaction is needed. Author

N73-22450# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AUTOMATIC LASER TRACKING SYSTEM: DIGITAL CONTROL AND SIMULATION Ph.D. Thesis - Paris Univ., Orsay, France, 29 May 1972
Elie Haziza 1972 101 p refs In FRENCH; ENGLISH summary
(ONERA-NT-198) Avail: NTIS HC $7.25

Inputs for the digital control and simulation program are on the one hand the pointing error, quantified with only five possible values, and on the other hand the position of the turret, provided by optical encoders. The real time control program, written with a view to minimize computation times, provides the target angular velocities, ensures the echo validation and takes into account a possible loss of echo. The simulation program permitted, after real tests, to improve the control program, either by reducing the cost function, or by passing from the first to the second order the velocity error estimation. Author

N73-22451# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
LIGHT SOURCE AND GEOMETRICAL REQUIREMENTS FOR THE OPTIMISATION OF OPTICAL-ANEMOMETRY SIGNALS
F. Durst and J. H. Whitelaw May 1972 25 p refs Sponsored by Science Research Council
(ET/TN/A/18) Avail: NTIS HC $3.25

The criteria for the design of optical arrangements for laser anemometry are formulated for reference-beam, two-beam, and single-beam modes of operation. The dependence of useful light intensity upon optical pathlength difference and number of axial laser modes is calculated. Laser power requirements are evaluated and the dependence upon band-pass filtering is quantitatively assessed. A new two-channel integrated-optical unit, with light-path compensation, and embodying the proposed design criteria, is described. Author

N73-22452# Avco-Everett Research Lab., Everett, Mass.
SHORT PULSE ELECTRIC CO2 LASER RESEARCH Final Technical Report, 1 Jul. 1971 - 30 Sep. 1972
G. S. Janes Jan. 1973 33 p refs
(Contract F44620-71-C-0131; AF Proj. 9752)
(AD-756456; AFOSR-72-0112TR) Avail: NTIS CSCL 20/5

A theoretical model was developed for the CO2 laser operating in a short pumping time, gain switched, mode-locked mode of operation. This model predicted the performance of a nanosecond E-beam ionizer-sustainer laser oscillator. Additional investigations showed the possibility of providing high energy nanosecond pulses from a CO2 laser MOPA chain and predicted output energies presently achievable with devices in existence and under construction. Modifications were designed and incorporated to an existing AERL E-beam ionizer-sustainer laser and demonstrated the capability of operating the device in a gain switched mode. Further investigations and experiments under other contracts and with internal funding are in process to achieve 0.1 - 1.0 joule pulses in one nanosecond as well as amplification experiments once this output is achieved. GRA

N73-22453# Xonics, Inc., Van Nuys, Calif.
THEORETICAL STUDIES OF HIGH-POWER INFRARED WINDOW MATERIALS Final Technical Report, 7 Dec. 1971 6 Dec. 1972
Marshall S. Sparks Dec. 1972 174 p refs
(Contract DAHC15-72-0129; ARPA Order 1969)
(AD-756080) Avail: NTIS CSCL 20/5

In the report, new results on the multiphonon infrared absorption are reported, a theory of infrared absorption by macroscopic inclusions in crystals is presented, experimental curves of beta vs omega, collected from the literature, are included, and a list of references to previous multiphonon calculations is given. GRA

N73-22454# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
AN INVESTIGATION OF THE PRINCIPLES AND TECHNIQUES OF BRAGG DIFFRACTION LASER BEAM PROBING OF AN ULTRASONIC FIELD M.S. Thesis
Robert David Brown, Jr. Dec. 1972 39 p refs
(AD-756521) Avail: NTIS CSCL 20/1

Probing of the near field of an ultrasonic beam in water with a thin laser beam has verified that a diffracted beam of light, whose amplitude is a function of the angle of incident light, is related to the spatial Fourier spectrum of the far-field acoustic distribution. There are indications that this method of probing may be useful in evaluating transducer mountings. As an application of the technique, reflection-transmission properties of sound on a liquid-liquid interface are examined, and the detection of evanescent waves verifies their physical existence and properties. Author (GRA)

N73-22455# Texas Univ., Dallas.
INVESTIGATION OF THE FEASIBILITY OF THE ELECTRON BEAM EXCITED HIGH PRESSURE RECOMBINATION LASER Annual Technical Report, 21 Mar. - 31 Dec. 1972
Carl B. Collins, Austin J. Cunningham, and Brian W. Johnson 28 Feb. 1973 120 p refs
(Contract N00014-67-A-0310-0007; ARPA Order 1807)
(AD-756681; UTDP-A003-1; ATR-1) Avail: NTIS CSCL 20/5

The objective of the research described in this report is to determine the feasibility of developing a recombining electron beam-excited plasma into a pulsed laser of exceptionally high peak power. Currently accepted theory indicates that this should be possible. An electron beam-excited helium afterglow system, operating routinely at 5 atmospheres and capable of modification to 20, was developed and instrumented so that spectroscopic observation of transient emissions in the visible and near IR region could be made with 10 nanosecond resolution. Construction details and system performance are presented. GRA

N73-22456# United Aircraft Corp., East Hartford, Conn.
STABILITY OF IONIZED MOLECULAR GAS FLOWS Annual Report, 15 Mar. 1972 - 14 Mar. 1973
W. L. Nighan, Walter J. Wiegand, and Robert H. Bullis 14 Mar. 1973 51 p refs
(Contract N00014-72-C-0380)
(AD-757083; UARL-M921325-2) Avail: NTIS CSCL 20/5

A theoretical investigation of the factors influencing the stability of molecular gas discharges typical of those utilized in high power laser systems has been carried out. These studies have revealed the mechanisms by which basic electronic, ionic, and neutral collision processes effect discharge plasma stability. The details of the electron-molecule attachment process, the characteristics of the resulting negative ion, and the nature of the negative ion detachment mechanism have been found to be particularly important. In addition, it has been shown that

conditions typically encountered in molecular laser discharges are compatible with the occurrence of both ionization instability. The report summarizes in tutorial fashion the key findings of the research completed to date, and identifies areas of importance which will receive emphasis in forthcoming investigations.
Author (GRA)

N73-22457# GTE Labs., Inc., Waltham, Mass.
HIGH ENERGY PULSE LIQUID LASER Semiannual Technical Summary Report
H. Samelson, R. Kocher, and A. Lempicki 28 Feb. 1973 20 p refs
(Contract N00014-68-C-0110; ARPA Order 1806)
(AD-757072; TR-73-826.1) Avail: NTIS CSCL 20/5

The report covers the construction of a liquid laser designed for operation as an oscillator-amplifier in the high brightness mode. The new aspects of the design of the laser cells, the cooling system and the power supply are presented and discussed. The entire system is nearly ready to be put into operation.
Author (GRA)

N73-22458# Naval Postgraduate School, Monterey, Calif.
LASER LIGHT ABSORPTION CHARACTERISTICS OF A LASER PRODUCED HYDROGEN PLASMA M.S. Thesis
James Allen Carlisle Dec. 1972 42 p refs
(AD-756524) Avail: NTIS CSCL 20/9

Light from a neodymium doped glass laser was focused in hydrogen gas at pressures from 20 millitorr to 62 atmospheres in order to produce optical breakdown of the gas. In the cases where breakdown was experienced, absorption of the remainder of the laser pulse by the resulting plasma was studied. It was found that the hydrogen plasma had some very distinct absorption characteristics; in that, absorption was very small at pressures slightly exceeding the threshold for optical breakdown, and very strong at pressures above one atmosphere. There was strong evidence of a frequency shift greater than 35 angstroms of the laser light as a result of its transit through the plasma. Photographs of the forward transmitted laser intensity pulses after breakdown were compared in time with a similar pulse in which no breakdown was experienced.
Author (GRA)

N73-22459*# ARO, Inc., Arnold Air Force Station, Tenn.
SIGNAL-CONDITION ELECTRONICS FOR A VECTOR VELOCITY LASER VELOCIMETER Final Report, 1-31 May 1973
F. L. Crosswy and J. O. Hornkohl AEDC Feb. 1973 44 p refs Sponsored in part by AEDC
(NASA Order L-52080)
(NASA-CR-131475; AD-755842; AEDC-TR-72-192; ARO-OMD-TR-72-1) Avail: NTIS HC $4.25 CSCL 20F

The signal-conditioning electronics used to interface a recently developed Bragg cell-type vector velocity laser velocimeter (LV) to a signal processor and data acquisition system are described. The Bragg cell LV eliminates the 180-deg velocity direction ambiguity problem of the conventional LV but in turn imposes a unique signal-conditioning problem. The signal characteristics and the signal-conditioning problem are defined, and signal-conditioning electronic circuits are described. Initial LV system evaluation data are presented for two orthogonal velocity component, atmospheric wind measurements. The Bragg cell LV-electronics system is shown to be readily expandable to a three-dimensional vector velocity measurement system.
Author (GRA)

N73-22460# American Optical Co., Southbridge, Mass. Research Div.
MULTIPLE DOPED ERBIUM LASER MATERIALS Final Report, 1 Oct. 1971 - 30 Sep. 1972
Richard F. Woodcock Jan. 1973 33 p refs
(Contract DAAB07-72-C-0053; ARPA Order 1464)
(AD-755687; ECOM-0053-F) Avail: NTIS CSCL 20/5

The goal to be attained under this contract is to develop erbium doped laser glasses whose performance characteristics exceed those of previously developed erbium doped materials. One phase of the program is to optimize the laser rod configuration. The effect on laser threshold and efficiency of laser rod length, diameter, and total Er(3)-ion content is reported. Consideration was given to the Double-U laser rod which should provide more efficient coupling; results are discussed. The second phase of the program is to develop high purity phosphate core and cladding glasses which combine the higher oscillator strength of the phosphate glasses with the improved sensitization technique possible with the clad laser rod configuration. Efforts toward obtaining these high purity phosphate glasses, fabrication problems of clad rods of phosphate glass, sensitization of the cladding and determination of core and cladding compatibility are discussed.
Author (GRA)

N73-22461# Sanders Associates, Inc., Nashua, N.H. Electro-Optics Div.
DEVELOPMENT OF MULTIPLY SENSITIZED Ho-YLF AS A LASER MATERIAL Final Report, 1 Sep. 1971 - 31 Aug. 1972
Evan P. Chicklis, Robert C. Folweiler, Charles S. Naiman, Arthur Linz, and Hans P. Jenssen Jan. 1973 104 p refs
(Contract DAAB07-71-C-0013; ARPA Order 1868)
(AD-755530; YPF-5126-R1; ECOM-0013-F) Avail: NTIS CSCL 20/5

The results of a twelve month program to investigate the physical, spectroscopic and laser properties of multiply sensitized Ho:YLF are presented. High two micron laser operating efficiencies at room temperature are obtained in this material as the result of absorption of pump radiation by the heavily doped sensitizing (Er(3-)-Tm(3-)-Yb(3-) ions with subsequent, rapid transfer to the active (Ho3-) species. Laser emission in the 2.06 micrometer region occurs via stimulated emission of the 517 - 518(Ho(3-) transition. A description of the technique for growth of YLF single crystals together with modifications performed during this program is included. The results of mass spectrographic analysis and chemical analysis of selected growth runs are presented. Phenomenological models of the energy transfer process have been constructed from which predictions of transfer efficiency variations with composition can be made.
GRA

N73-22462# Massachusetts Inst. of Tech., Cambridge.
ATMOSPHERIC PRESSURE GAS LASERS Semiannual Technical Report, 1 Jun. - 30 Nov. 1972
Herman A. Haus 25 Jan. 1973 10 p refs
(Contract DAHC04-72-C-0044; ARPA Order 675)
(AD-755477) Avail: NTIS CSCL 20/5

A single short pulse of width less than the round-trip transit time of a transversely excited laser can be produced by means of simultaneously mode locking and cavity dumping of the laser. Using the above method, single pulses less than 4-nsec wide, with peak power greater than 10 kW have been produced from a TEA CO2 laser.
Author (GRA)

N73-22463# Naval Underwater Systems Center, Newport, R.I.
A HOLOGRAPHIC AND ACOUSTICAL INVESTIGATION OF A PLATE VIBRATING UNDERWATER
Rudolph E. Croteau, Jr. 24 Oct. 1972 172 p refs
(AD-755475; NUSC-TR-4447) Avail: NTIS CSCL 14/2

An elaborate experiment was undertaken to determine the interrelationships between dynamic surface deformation (whose data were obtained through optical interferometric holography) and the resulting radiated acoustic pressure pattern. Following analytical derivations and the development of a suitable algorithm, it was concluded that one hologram, by itself, does not contain sufficient information to make accurate predictions of acoustic patterns. Suggestions are made regarding follow-up investigations for the determination of the gradient of the surface deformation.
Author (GRA)

N73-22464# Ohio State Univ., Columbus. Electroscience Lab.
INVESTIGATION OF LASER PROPAGATION PHENOMENA Quarterly Technical Report, Jul. - Oct. 1972
Stuart A. Collins, Jr. and G. W. Reinhardt Nov. 1972 27 p refs
(Contract F30602-72-C-0305; ARPA Order 1279)
(AD-755404; ESL-3432-3; RADC-TR-72-328; QTR-2) Avail: NTIS CSCL 20/5

A complete analytical description of a device to measure angle of arrival is presented along with predictions of expected results for various input apertures and turbulence conditions. This work is necessary for defining experiments made with instrument of RADC. Also presented are some extensions of previous

work on temporal spectra of phase difference measurements. Specifically the case for slanted paths is considered. Author (GRA)

N73-22465# Optitron, Inc., Torrance, Calif.
NERNST LAMP FOR LASER PUMPING Final Progress Report, 1 Jan. - 30 Nov. 1972
Slava A. Pollack and Joseph J. Caldwell, Jr. 25 Jan. 1973 52 p refs
(Contract N00014-72-C-0071; NR Proj. 017-735)
(AD-755207) Avail: NTIS CSCL 20/5

The purpose of the project was to undertake the study, development and construction on a best effort basis of an experimental incandescent lamp of Nernst glower type for pumping a cw alphabet YLF laser using ceramic conductors with properties of selective thermal radiators for the light emitting elements. Progress in each of these areas has been made. Ceramic material research efforts have been conducted. Materials were selected and tested for their spectral thermal and electrical properties. Various glower laser pump configurations have been made and tested. A complete laser pump system, including cooling, has been made and tested. A complete laser pump system, including cooling, has been built, tested and delivered to the contractor. Author (GRA)

N73-22466# Naval Postgraduate School, Monterey, Calif.
DESIGN AND CONSTRUCTION OF A CW DYE LASER M.S. Thesis
Karl-Heinz Friedrich Kelle Jun. 1972 58 p refs
(AD-756514) Avail: NTIS CSCL 20/5

The properties of organic dyes as well as the lasing process of organic dye lasers are investigated to form the basis for the design of a cw dye laser. Different dye laser systems are compared with regard to stability, utility, and construction characteristics. A folded three mirror resonator with an inserted dye cell at the Brewster angle is chosen and analyzed. The astigmatic effects introduced by the tilted mirror can be offset by those from the dye cell to yield a compensated cavity. The trade-offs and limitations given by the cell thickness, the angle of incidence, and the focal length of the center mirror are discussed. Finally, experimental data and procedures are given. Author (GRA)

N73-22467# Naval Postgraduate School, Monterey, Calif.
DISCHARGE CHARACTERISTICS OF A CARBON DIOXIDE TEA LASER M.S. Thesis
Ronald Floyd Bishop Dec. 1972 72 p refs
(AD-756517) Avail: NTIS CSCL 20/5

During the past two years a rapid development in the field of high pressure CO2 lasers has been witnessed. However, in the haste of this development very little effort had been expended to understand the detailed aspects of the discharge characteristics of such lasers. The results of a parametric study of the discharge characteristics of an atmospheric pressure, double-discharge CO2 laser are reported. The results discussed include: A clarification of the important role played by helium in establishing good discharge conditions; measurements of plasma resistivity as a function of gas content and circuitry elements; establishment of a satisfactory operating regime in parameter space for a double-discharge laser with a two-centimeter gap; and a discussion of the major problems limiting the operation of such a laser. The results presented should be applicable to a wide class of double-discharge gas lasers. Author (GRA)

N73-22468# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
HIGH EFFICIENCY, SINGLE-FREQUENCY LASER AND MODULATOR STUDY Quarterly Summary Technical Status Report No. 7
Robert C. Ohlmann, W. Culshaw, K. K. Chow, H. V. Hance, W. B. Leonard, and J. Kannelaud 30 Nov. 1972 44 p
(Contract N00014-71-C-0049; ARPA Order 306)
(AD-755219; LMSC-N-JY-71-14) Avail: NTIS CSCL 20/5

The general objective of the research is to conduct investigations that will contribute to the development of an ultrawide-bandwidth laser communication system. The specific objectives are: a study of laser communication system configurations, particularly modulation formats, that are most suitable for very high data rates up to 2 Gbit/sec, research on high-efficiency, single-frequency Nd:YAG lasers as the transmitter source for such a communication system, and research on an optical modulator with 2 GHz of RF bandwidth and good modulation efficiency. During the present reporting period, work has continued on improving the efficiency and ease of single-frequency operation of Nd:YAG lasers, together with work on the extension of the bandwidth of the optical modulator. GRA

N73-22469# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY OF THE EFFECT OF BUFFER GAS PRESSURE ON THE KINETICS OF THE GENERATION SPECTRUM OF PHOTODISSOCIATION LASER
V. N. Volkov and I. G. Zubarev 6 Jan. 1973 11 p refs Transl. into ENGLISH from Vysokomolekul. Soedin., Ser. B. Kratkie Soobshcheniya (Moscow), no. 1, 1972 p 27-31
(AD-756334; FTD-HT-23-1730-72) Avail: NTIS CSCL 20/5

Special experiments were conducted to clarify questions concerning the effect of buffer gas pressure on kinetics of the generation spectrum of a photodissociation laser. The block diagram of the apparatus used is given. This apparatus includes a coaxial flashlamp in which the active substance is placed to prevent nonuniformity in the refractive index caused by pressure variation. Pressures of 15, 150, and 760 torr and a xenon partial pressure of 120 torr are used. Author (GRA)

N73-22470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIGHT INTENSITY FLUCTUATIONS IN DIVERGING BEAMS
A. S. Gurvich 5 Feb. 1973 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gorky), V. 12, no. 1, 1969 p 147-149
(AD-756094; FTD-HT-23-1863-72) Avail: NTIS CSCL 20/5

The research presents a calculation of the dispersion of the light intensity logarithm along the axis of a laser beam propagating in the atmosphere. General formulas, derived by Schmeltzer (1967) by a smooth perturbation technique to describe the propagation of a bounded monochromatic light beam, are used in the calculations. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-22471 Case Western Reserve Univ., Cleveland, Ohio.
STRESS CORROSION CRACKING AND HYDROGEN EMBRITTLEMENT IN 410 STAINLESS STEEL Ph.D. Thesis
Michael Francis McGuire 1972 46 p
Avail: Univ. Microfilms Order No. 72-26185

The stress corrosion cracking behavior of two bcc stainless steels was investigated as a function of yield strength, applied potential, and temperature in several dilute salt solutions. Hydrogen permeation rates for the same environmental and material conditions were obtained. The dynamics of stress corrosion crack propagation were observed microscopically. The sensitivity of the materials to hydrogen gas embrittlement as a function of yield strength and temperature was determined. The susceptibility to SCC decreased with yield strength to a threshold strength which was in turn a function of temperature. Under all conditions, the occurrence of stress corrosion cracking could be accounted for by a hydrogen embrittlement mechanism rather than either an adsorption of anodic dissolution process. Dissert. Abstr.

N73-22472 Case Western Reserve Univ., Cleveland, Ohio.
ENVIRONMENTAL INDUCED FAILURE OF A HIGH STRENGTH ALUMINUM ALLOY Ph.D. Thesis
Robert Jean-Marie Gest 1972 135 p
Avail: Univ. Microfilms Order No. 72-26157

This dissertation is an attempt to elucidate stress corrosion cracking in aluminum alloys and extend the concept of hydrogen embrittlement to non-transition metals. A high strength aluminum alloy 7075 T 651 exhibits classical strain aging type of embrittlement after cathodic hydrogenation. The embrittlement

is essentially reversible on vacuum degassing. Hydrogen permeation has been observed under both anodic and cathodic polarization. The coefficient of diffusion is approximately 2 x 10 to the minus 9th power sq cm/sec. It appears that surface reactions are rate controlling. Also stress corrosion cracking has been observed under precisely the same conditions that produce hydrogen embrittlement. It is concluded that, the hydrogen permeation, the sensitivity to hydrogen embrittlement and the features of the SCC in this alloy indicate that hydrogen plays a major role in their stress corrosion failure. Dissert. Abstr.

N73-22473 Pennsylvania Univ., Philadelphia.
ELECTRONIC PROPERTIES OF VANADIUM NITRIDES Ph.D. Thesis
Fouad Iskander Ajami 1972 106 p
Avail: Univ. Microfilms Order No. 72-25356

The electrical structure of VN was investigated by studying some of its properties as a function of nitrogen content. Pure samples of vanadium nitride were prepared by reacting thin foils (0.012 cm) of pure vanadium metal in a nitrogen/argon mixture at 1200 C. The composition of the samples, in the range V(N0.72) - VN, was controlled by varying the N2/Ar ratio. In that range of composition VN exists in the (fcc) defect structure, with vacancies in the nitrogen sublattice. The lattice constant varied linearly with nitrogen content from 4.06 A for V(N0.72) to 4.14A for VN. The magnetic susceptibility, superconducting transition temperature, electrical resistivity, Seebeck coefficient, and Hall coefficient were measured. The general behavior of the vanadium nitrides is concluded to be similar to that of transition metal alloys. Dissert. Abstr.

N73-22474*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED COATINGS FOR REFRACTORY METALS Patent Application
Salvatore J. Girsaffe and Stanley R. Levine, inventors (to NASA) Filed 4 May 1973 10 p
(NASA-Case-LEW-11179-1; US-Patent-Appl-SN-357312) Avail: NTIS HC $3.00 CSCL 11D

Improvement in the protective ability of a coating having a higher thermal expansion coefficient than the metal it covers is described. The invention is particularly directed to protecting space shuttle reentry thermal protection systems, aircraft gas turbine engine components, and other applications where coatings must provide environmental protection for refractory metals. Silicide coatings on refractory metals were modified to improve their resistance to cracking while further modifying other physical properties that affect their high temperature performance. Discrete particles or fibers are incorporated in the coating as inclusions by imbedding the particles in the substrate surface. The result is that the improved coatings have greater resistance to cracking. NASA

N73-22475*# Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF ALLOY COMPOSITION ON THE MECHANISM OF STRESS-CORROSION CRACKING OF TITANIUM ALLOYS IN AQUEOUS ENVIRONMENTS Annual Summary Report, 11 Jun. 1971 - 10 Jun. 1972
R. A. Wood, J. D. Boyd, D. N. Williams, and R. I. Jaffee Jun. 1972 102 p refs Sponsored by NASA
(NASA-CR-131872) Avail: NTIS HC $7.25 CSCL 11F

A detailed study was made of the relation between the size distribution of Ti3Al particles in a Ti-8Al alloy and the tensile properties measured in air and in saltwater. The size distribution of Ti3Al was varied by isothermal aging for various times at temperatures in the range 770 to 970 K (930 to 1290 F). The aging kinetics were found to be relatively slow. Quantitative measurements of the particle coarsening rate at 920 K (1200 F) showed good agreement with the predicted behavior for coarsening controlled by matrix diffusion, and suggested that the specific free energy of the Ti3Al alpha interface in negligible small. In all cases, the Ti3Al particles were sheared by the glide dislocations. It was concluded that there is a definite correlation between the presence of deformable Ti3Al particles and an alloy's susceptibility to aqueous stress corrosion cracking. Furthermore, the appearance of the surface slip lines and the dislocation substructure in deformed specimens suggest that the specific effect of the Ti3Al particles is to cause a nonhomogeneous planar slip character and an enhanced chemical potential of the slip bands. Author

N73-22476*# Eagle-Picher Industries, Inc., Joplin, Mo. Research Labs.
STUDY OF SINGLE CRYSTALS OF METAL SOLID SOLUTIONS Summary of tasks 1 and 2
J. P. Doty and J. A. Reising 21 Mar. 1973 45 p refs (Contract NAS8-29077)
(NASA-CR-124212) Avail: NTIS HC $4.25 CSCL 11F

The parameters and requirements for growing single crystals of relatively high melting point metals in a zero gravity environment are studied. The crystal growth of metals such as silver, copper, gold, and alloys with a melting point between 900-1100 C is examined. Author

N73-22477# Joint Publications Research Service, Arlington, Va.
SELECTED TRANSLATIONS ON METALLURGY
30 Mar. 1973 126 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (Sverdlovsk), v. 34, no. 6, 1972
(JPRS-58611) Avail: NTIS HC $8.50

The chemical reactions involved in the development of metallic alloys are discussed. The subjects include: (1) the theory of superplasticity, (2) plastic growth in cracks, (3) structural recrystallization of steels, (4) precipitation on a cobalt-tungsten-titanium alloy, (5) strain aging of martensite of quenched steel, and (6) strengthening of solid bodies by nuclear gamma resonance. For individual titles, see N73-22478 through N73-22490.

N73-22478 Joint Publications Research Service, Arlington, Va.
ON THE THEORY OF SUPERPLASTICITY
K. P. Gurov, M. Kh. Shorshorov, A. S. Tikhonov, and N. I. Nadirashvili *In its* Selected Transl. on Met. 30 Mar. 1973 p 1-8 refs (For availability see N73-22477 13-17)

A theoretical model is proposed in which the optimum conditions of superplasticity are connected with the maximum developed interphase surface of the fluctuation nuclei of the new phase. An estimate of the distribution of these nuclei according to dimensions, as a function of temperature, is performed from the standpoint of the theory of pre-transitional phenomena. A comparison of the calculation data with the experimental results for a number of systems demonstrated the validity of such a model. Author

N73-22479 Joint Publications Research Service, Arlington, Va.
PLASTIC GROWTH OF CRACKS c26
Yu. I. Poliektov and V. V. Rybin *In its* Selected Transl. on Met. 30 Mar. 1973 p 9-25 refs (For availability see N73-22477 13-17)

By means of a raster electron microscope, the fracture of a mixed viscous-brittle breakage of a polycrystal was studied. Viscous cracks were observed simultaneously in the transverse section and on a plane. On the transverse section, a strongly developed heterogeneous plastic deformation (strain) was ascertained, which is localized near the crack. On the plane the viscous crack has a conventional cup-shaped structure. An attempt was made to match the features of the heterogeneous plastic strain with the features of the cup-shaped fracture of the viscous crack. A model of the formation and development of a viscous crack is proposed. Certain conclusions from this model are discussed. Author

N73-22480 Joint Publications Research Service, Arlington, Va.
ANOMALY OF YOUNG'S MODULUS IN DISPERSION HARDENED INVARS
O. A. Khomenko and A. V. Sazykina *In its* Selected. Transl. on Met. 30 Mar. 1973 p 26-37 refs (For availability see N73-22477 13-17)

The anomaly of the modulus of elasticity in dispersion-hardened invars treated for maximum strength is considered. It is demonstrated that the anomaly of the modulus of elasticity and its temperature coefficient in alloys containing titanium is determined mainly by the invar effect. The amplification of the concentration heterogeneity of austenite in the formation of zones of the Guignet-Preston type and the liberation of the intermetallides causes an increase in the contribution of

mechanostriction of the paraprocess to the elastic behavior of the invars. Author

N73-22481 Joint Publications Research Service, Arlington, Va.
STRUCTURAL RECRYSTALLIZATION OF STEELS DURING FAST AND SLOW HEATING
G. N. Bogacheva, V. P. Drozd, A. V. Ozhiganov, V. M. Schastlivtsev, and V. M. Umova *In its* Selected Transl. on Met. 30 Mar. 1973 p 38-49 refs (For availability see N73-22477 13-17)

The effect of small additions of elements forming carbides that are nearly insoluble, the temperature of preliminary hardening, tempering after hardening, and soaking at various temperatures in the austenite region on the structural mechanism of the recrystallization of steel during heating, accomplished with various speeds, was investigated. It was demonstrated that the factors indicated do not have the same effect on the manifestation of the structural succession, expressed in the restoration of the initial grains of austenite after completion of the phase transformation in fast heating (200--400 deg per second) and slow heating (1--2 deg per minute). In connection with this it is proposed that these two cases of structural succession are caused by different mechanisms of the formation of austenite. Author

N73-22482 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE EXTENT OF INITIAL STATE NONEQUILIBRIUM ON THE STARTING TEMPERATURE OF THE GAMMA-TO-ALPHA TRANSFORMATION IN STEELS
V. P. Tarabanova, S. S. Dyachenko, and A. M. Petrichenko *In its* Selected Transl. on Met. 30 Mar. 1973 p 50-60 refs (For availability see N73-22477 13-17)

A decrease in the temperature of the beginning of the alpha to gamma transformation in steels with nonequilibrium structures was observed. The effect is explained by the increase in free energy of the object in the origin of defects in the crystal structure. The density of dislocation causing the decrease in temperature at the beginning of the formation of austenite below the equilibrium critical point was estimated. Author

N73-22483 Joint Publications Research Service, Arlington, Va.
THE PROCESS OF PRECIPITATION IN A COBALT-TUNGSTEN-TITANIUM ALLOY
A. L. Berezina, L. P. Gunko, and K. V. Chuistov *In its* Selected Transl. on Met. 30 Mar. 1973 p 61-69 refs (For availability see N73-22477 13-17)

The precipitation process in cobalt-tungsten-titanium alloys was observed using electron microscope and X-ray techniques. In the temperature range of 500 to 600 C, a homogeneous formation of an intermediate beta prime phase was observed. The origin of the beta prime phase is accompanied by the appearance of superstructural maximums and satellites on the X-ray photographs near the reflections from the cubic matrix. It was established that during the process of the growth of a particle of the beta prime phase, a periodic modulated structure is formed. The aging of the alloy at high temperatures is characterized only by continuous precipitation. Author

N73-22484* Joint Publications Research Service, Arlington, Va.
A STUDY OF STRAIN AGING OF MARTENSITE OF QUENCHED STEEL
Yu. S. Dubov and B. M. Mogutnov *In its* Selected Transl. on Met. 30 Mar. 1973 p 70-77 refs (For availability see N73-22477 13-17)
Avail: NTIS

The strain aging of high-carbon quenched steels caused by plastic deformation of martensite is discussed. An analysis of the processes of migration of the carbon to defects formed in the martensite transformation was conducted. The phenomenon occurs when carbon which is not bonded with the imperfections of the crystal structure and fresh defects are contained in the martensite. Its occurrence was fixed according to the variation of the mechanical properties of the steel and the amplitude dependence of internal friction. Author

N73-22485 Joint Publications Research Service, Arlington, Va.
EFFECT OF VARIOUS COMBINATIONS OF AGING AND DEFORMATION ON THE STRUCTURE AND MECHANICAL PROPERTIES OF EI437B ECOLOGY
N. N. Buynov, A. I. Uvarov, A. N. Uksusnikov, R. R. Romanova, R. A. Karakhanyan, and M. G. Gaydukov *In its* Selected Transl. on Met. 30 Mar. 1973 p 78-89 refs (For availability see N73-22477 13-17)

The effect of deformation performed after low-temperature aging before high-temperature aging on the structure and mechanical properties of alloy EI437B was studied. Experimental data confirming the possibility of decreasing or preventing recovery in this alloy by means of moderate deformation between low-temperature and high-temperature agings were obtained. It was established that the use of treatment according to the following scheme: hardening low-temperature aging deformation (straining) high-temperature aging leads to an essential increase of the mechanical properties in comparison with aging without deformation. Author

N73-22486 Joint Publications Research Service, Arlington, Va.
STUDY OF THE PROCESS OF STRENGTHENING SOLID BODIES BY MEANS OF NUCLEAR GAMMA RESONANCE
G. N. Belozerskiy, V. N. Gittsovich, O. G. Sokolov, and Yu. P. Khimich *In its* Selected Transl. on Met. 30 Mar. 1973 p 90-95 refs (For availability see N73-22477 13-17)

The physical processes responsible for the strengthening of metallic alloys by using the method of nuclear gamma resonance were studied. The application of nuclear gamma spectroscopy was used because of the sensitivity to the phase composition of the specimens. The strengthening of the material is associated with the change of the structural state of the crystal lattice and especially with the change of the degree of defect occurrence. Experiments were conducted on specimens of iron-vanadium steel which had passed through various types of heat treatment for the purpose of changing the strength properties. Author

N73-22487 Joint Publications Research Service, Arlington, Va.
THERMAL STABILITY OF THE MICROSTRUCTURE OF THE Al--Al3Ni EUTECTIC COMPOSITION
Yu. P. Kurilo, A. I. Somov, and A. S. Tortika *In its* Selected Transl. on Met. 30 Mar. 1973 p 96-104 refs (For availability see N73-22477 13-17)

The high-temperature stability of the reinforcing phase in the eutectic composition Al--Al3Ni, obtained in a wide range of rates of growth, was experimentally investigated. The dependence of the dispersivity of the reinforcement upon the temperature and the annealing time of the composition was found. The behavior of the macrostructure characteristics of the composition (grains, colonies) at increased temperatures was studied. Author

N73-22488 Joint Publications Research Service, Arlington, Va.
FEATURES OF THE STRUCTURE AND PLASTIC DEFORMATION OF ZIRCONIUM SATURATED BY NITROGEN AND OXYGEN
V. M. Azhazha, P. V. Vyugov, L. N. Ryabchikov, and V. A. Finkel *In its* Selected Transl. on Met. 30 Mar. 1973 p 105-110 refs (For availability see N73-22477 13-17)

The effect of the saturation with nitrogen and oxygen at low pressure on the mechanical properties, plastic deformation, and structure of zirconium iodide was determined. The preparation of the specimens and the conditions for obtaining gas saturation are described. The quantity of gas absorbed was controlled by chemical analyses. After saturation by the gases, the zirconium specimens were annealed for the purpose of homogenization. The conditions under which the mechanical properties were tested are discussed. Author

N73-22489 Joint Publications Research Service, Arlington, Va.
ON THE ELECTRICAL CONDUCTIVITY OF DIRECTIONALLY CRYSTALLIZED COMPOSITION Al--Al3Ni
V. Ye. Semenenko, A. I. Somov, and V. I. Tutov *In its* Selected Transl. on Met. 30 Mar. 1973 p 111-117 refs (For availability see N73-22477 13-17)

An investigation of the electrical conductivity of an aluminum-nickel eutectic alloy was conducted. The method of directional crystallization was used. The method by which the eutectic system was unidirectionally crystallized is explained. At all rates of growth a primary mutual connection of the interphase between the phases of aluminum and nickel was observed. The conditions under which the electrical conductivity was investigated are described. Author

N73-22490 Joint Publications Research Service, Arlington, Va.
ON THE DEPENDENCE OF MARTENSITE MORPHOLOGY ON THE TEMPERATURE OF THE ISOTHERMAL TRANSFORMATION OF F--24Ni--3Mn ALLOY
V. V. Golikova and V. I. Izotov *In its* Selected Transl. on Met. 30 Mar. 1973 p 118-122 refs (For availability see N73-22477 13-17)

A metallographic investigation of the morphological features of martensite formed in an alloy of iron-nickel-manganese-carbon was conducted. The material was hardened at 1150 C for four hours and subsequent cooling in isothermal conditions at various temperatures was completed. After transformation at minus forty C, two morphological varieties of martensite were ascertained. The microstructure of the specimens is described and illustrated. Mechanical and physical alterations in the crystal structure are described. Author

N73-22491# Aeronautical Research Labs., Melbourne (Australia).
FRACTURE MECHANICS STUDIES OF FATIGUE CRACK PROPAGATION IN 2024 ALUMINUM ALLOY PANELS CONTAINING TRANSVERSE SLITS
R. Ellis Aug. 1972 35 p refs
(ARL/SM-379) Avail: NTIS HC $3.75

An experimental investigation was undertaken in order to produce suitable fatigue cracks in 2024-T3 aluminum alloy panels containing manufactured slits, the panels themselves being required for a future residual strength test program. A relatively large amount of crack propagation data was generated, and this was analyzed using a fracture mechanics approach. Most of the data correlated reasonably well with Paris's nth power crack propagation law, and this would appear to be a useful design tool when there is a requirement to produce controlled cracking from panels containing slits. Author

N73-22492# National Aerospace Lab., Amsterdam (Netherlands).
FRACTURE TOUGHNESS AND SUBCRITICAL CRACK GROWTH IN A HIGH STRENGTH TITANIUM ALLOY (IMI 550)
R. J. H. Wanhill, A. E. Meulman, and W. J. VanderVet 28 Aug. 1972 36 p refs
(NLR-TR-72107-U) Avail: NTIS HC $4.00

Fracture toughness and aqueous stress corrosion tests in 3.5% NaCl and distilled water was carried out on specimens taken from a thick forged rectangular bar of IMI 550. Fracture toughness tests for longitudinal crack growth specimens gave fairly uniform results with somewhat higher values than for transverse crack growth specimens. Fracture toughness values for transverse crack growth specimens from the outer portions of the forged bar were significantly lower than values near the centre of the bar. Aqueous stress corrosion values in both distilled and salt water were much lower than fracture toughness values. The results of all the tests, together with data from other sources, were used to discuss usage of the alloy in aircraft components. Author

N73-22493# Technische Hogeschool, Delft (Netherlands).
AN INTERPRETATION OF THE UV AND ESR SPECTRA OF SOME CHLOROCOMPLEXES OF TERVALENT TITANIUM Ph.D. Thesis
Herman Karel Ostendore 1973 119 p refs
Avail: NTIS HC $8.00

Configurations of the chlorocomplexes of titanium-III with acetonitrile and methanol are determined by finding relative positions of the sublevels of the 2D term of the titanium ion from g-values of the ERS spectrum and the d-d transitions in the ultraviolet spectrum. The crystal field approximation or the molecular orbital sppproximation are used to establish second step parameters that govern the splitting of the 2D term. This method gives analytical expressions for the energies of orbitals with mainly d-character. G.G.

N73-22494# Joint Publications Research Service, Arlington, Va.
CREEP AND RUPTURE IN HEAT RESISTANT MATERIALS
16 Apr. 1973 18 p refs Transl. into ENGLISH from Probl. Prochnosti (Kiev), nos. 2 and 7, 1972
(JPRS-58760) Avail: NTIS HC $3.00

Extrapolation methods of stress-rupture strength test results are described along with an investigation of the laws governing creep and rupture in heat resistant materials. For individual titles, see N73-22495 through N73-22496.

N73-22495 Joint Publications Research Service, Arlington, Va.
PROBLEM OF EXTRAPOLATING STRESS-RUPTURE STRENGTH TEST RESULTS
V. K. Adamovich and Yu. N. Panichkin *In its* Creep and Rupture in Heat Resistant Mater. 16 Apr. 1973 p 1-7 refs (For availability see N73-22494 13-17)

A generalized parametric extrapolation technique is proposed for testing steels and alloys not only for operational application, but also for higher temperatures in order to obtain information about the processes determining the high-temperature strength of the material during its operating service life. Author

N73-22496 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF CERTAIN LAWS GOVERNING CREEP AND RUPTURE IN HEAT-RESISTANT MATERIALS
I. I. Trunin and N. G. Golubova *In its* Creep and Rupture in Heat Resistant Mater. 16 Apr. 1973 p 8-16 refs (For availability see N73-22494 13-17)

Fundamental principles of the creep-rupture strength of heat resistant alloys are dealt with in terms of the plastic properties and deformation characteristics which adversely affect refractory materials designed for long service periods. Methods of calculating average creep rates are provided along with detailed analyses of experimental data relative to a broad selection of steels. J.M.M.

N73-22497# Joint Publications Research Service, Arlington, Va.
STRUCTURAL-KINETIC STUDY OF THE OXIDIZABILITY OF NICKEL-CHROMIUM BASED ALLOYS
N. B. Abramova, D. V. Ignatov, and E. M. Lazarev 18 Apr. 1973 4 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 46, no. 5, 1972 p 1340-1341
(JPRS-58777) Avail: NTIS HC $3.00

A structural and kinetic study was made of the oxidizability of Ni + 10% Cr and Ni + 105 Cr + 6% W alloys containing 0.2% Ce, La, and Y at 1000 C. It was found that the introduction of additives of rare earth elements into the indicated alloys decreases their oxidation rate by 3 to 8 times; alloys containing yttrium have the greatest oxidation resistance. Author

N73-22498# Joint Publications Research Service, Arlington, Va.
FEATURES OF HEAT-RESISTANT STEEL RECRYSTALLIZATION
V. M. Yuferov and Ye. Ya. Lezinskaya 24 Apr. 1973 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk BSSR, Ser. Fiz.-Tekhn. Nauk (Minsk), no. 2, 1972 p 37-40
(JPRS-58840) Avail: NTIS HC $3.00

An investigation was made of the recrystallization of heat resistant steel. Author

N73-22499# Joint Publications Research Service, Arlington, Va.
HEAT RESISTANCE AND SINTERING OF NICKEL
18 Apr. 1973 16 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (Ordzhonikidze), no. 3, 1971
(JPRS-58779) Avail: NTIS HC $3.00

The oxidation kinetics for nickel and its hardened compositions are discussed along with the sintering process for heat resistant nickel alloys. For individual titles, see N73-22500 through N73-22501.

N73-22500 Joint Publications Research Service, Arlington, Va.
HEAT RESISTANCE OF PRECIPITATION-HARDENED NICKEL
E. I. Balakin, N. P. Zhuk, G. A. Meyerson, B. K. Opara, and O. A. Pashkova *In its* Heat Resistance and Sintering of Nickel 18 Apr. 1973 p 1-7 refs (For availability see N73-22499 13-17)

The oxidation kinetics for nickel and its hardened compositions with oxides was studied by the gravimetric method at 800 to 1200 C. It was found that the presence of hardening oxide particles in nickel leads to a change in the rate of its oxidation

in air. Stable oxides lower the oxidation rate of nickel. Temperature and oxidation time lead to a change in the heat resistance of Ni-MeO compositions. F.O.S.

N73-22501 Joint Publications Research Service, Arlington, Va.
SINTERING OF A HEAT-RESISTANT NICKEL-BASE ALLOY
S. S. Kiparisov, K. K. Kalinin, and T. L. Feshchenko *In its* Heat Resistance and Sintering of Nickel 18 Apr. 1973 p 8-14 refs (For availability see N73-22499 13-17)

The sintering process in the formation of heat resistant nickel alloys was investigated by X-ray analysis of the alloy microstructure. Microhardness, phase composition, and diffusion homogenization are discussed. F.O.S.

N73-22502# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VIBRATION DAMPING ABILITY OF STEEL EI961 AFTER DIFFERENT HEAT TREATING MODES
G. S. Krivonogov, M. F. Alekseyenko, and B. G. Livshits 12 Apr. 1972 8 p refs Transl. into ENGLISH from Rasseyaniye Energii pri Kolebaniyakh Mekhan. Sistem (Kiev), 1968 p 237-242
(AD-743119; FTD-HC-23-200-72) Avail: NTIS HC $3.00 CSCL 20/12

The performance of compressor blades of EI961 stainless Cr-Ni steel was investigated in relation to its damping and fatigue characteristics and the effect of prior heat treatment. The damping properties of the material at various stress levels were investigated with the aid of a set-up designed to investigate the dissipation of energy during longitudinal and torsional vibrations adapted to measure the logarithmic decrement of vibration damping over a broad range of deformation amplitudes as well as to perform measurements in the magnetic field of a solenoid with an intensity reaching 80 ka/m, which makes it possible to investigate the mechanisms of energy dissipation in ferromagnetic materials. The logarithmic decrement was measured during free damping vibrations of the specimen. Prior to these tests the specimens were subjected to different types of heat treatment. Author

N73-22503# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF STRENGTHENING PROPERTIES OF LAVES PHASES IN AUSTENITIC STEELS
F. N. Tavadze, M. I. Linchevskaya, B. S. Bokshteyn, and G. G. Surmava 25 Apr. 1973 4 p refs Transl. into ENGLISH from Soobshch. Akad. Nauk Gruz. SSR (USSR), v. 64, no. 3, 1971 p 632-636
(JPRS-58852) Avail: NTIS HC $3.00

An investigation of strengthening properties of laves phases in austenitic steels is reported. Author

N73-22504# National Aerospace Lab., Amsterdam (Netherlands). Div. of Structures and Materials.
FATIGUE DAMAGE ACCUMULATION AND INCOMPATIBLE CRACK FRONT ORIENTATION
J. Schijve 9 Jun. 1972 25 p refs
(NLR-TR-72061-U) Avail: NTIS HC #3.25

Crack propagation tests were performed on 2024-T3 and 7075-T6 specimens. Crack growth was observed under variable amplitude loading, during high stress amplitude cycles, associated with 45 deg mode cracking, whereas the crack front orientation was still at an angle of 90 deg. Similarly it was also studied during low stress amplitude cycles associated with 90 deg mode cracking, whereas the crack front was already at a 45 deg angle. Crack growth curves, fractographic information, and a brief discussion on interaction effects during fatigue damage accumulation are presented. Author (ESRO)

N73-22505# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
RESEARCH IN DEVELOPMENT OF IMPROVED TRIP STEELS Final Report
T. J. Koppenaal Jan. 1973 60 p refs
(Contract DAAG46-72-C-0047; DA Proj. 1T0-62105-A-349)
(AD-756953; AMMRC-CTR-73-4) Avail: NTIS CSCL 11/6

A program was conducted to establish thermal processing procedures directed at improving the strength of TRIP steels. The general approach was to strain hardened TRIP steels by thermal cycling between martensite and reverted austenite. Author (GRA)

N73-22506# Manlabs, Inc., Cambridge, Mass.
EFFECT OF CYCLIC TRANSFORMATION TREATMENTS ON THE STRUCTURE AND MECHANICAL PROPERTIES OF STEEL
S. A. Kulin, K. Kreder, and L. Kaufman Oct. 1972 57 p refs (Contract N00014-70-C-0039; NR Proj. 031-740)
(AD-756240) Avail: NTIS CSCL 11/6

Cyclic transformation of 4340 steel was employed to evaluate the structural changes and strengthening efficiency of this method of heat treatment. Section sizes up to one-half inch thick were evaluated. The results show a direct relation of austenite grain size and martensite lath size into the micron range. Composite structures with hard surfaces and soft cores can be obtained in one-half inch sections. Conversely, fully hardened structures can be obtained in one-half inch sections by controlling the cycling temperature. The efficiency of the cyclic strengthening treatment is determined by the grain size established as a result of the melting practice. Grain size or subgrain size is a more sensitive indicator of strength than imperfection structure. Yield strengths up to 350,000 psi were achieved in a 4340 steel by a ten percent rolling reduction of a cyclically produces martensite structure. Author (GRA)

N73-22507# Army Materials and Mechanics Research Center, Watertown, Mass.
PROCESSING OF 18 PERCENT Ni MARAGING STEEL (350 GRADE)
Armando A. Iannelli Sep. 1972 19 p refs
(AD-756422; AMMRC-PTR-72-4) Avail: NTIS CSCL 11/6

The study was conducted to show effect of processing procedures on mechanical properties of 18% nickel (350 grade) maraging steel. The material was subjected to variable forging, solution treatments and aging temperatures. Air melt versus vacuum melt comparisons are shown. Author (GRA)

N73-22508# Artech Corp., Falls Church, Va.
EVALUATION OF MULTILAYER THIN FILMS, PHASE 2 Final Report, 26 Jul. - 30 Sep. 1972
Fred Ordway Feb. 1973 36 p refs
(Contract DAAK02-72-D-0223)
(AD-756582; J7114.06-FR) Avail: NTIS CSCL 11/6

Thin films of aluminum and titanium alloys on collodion membranes were bulge tested and the strength of the films was calculated. The values obtained for films less than 500 A thick ranged above 0.5 Mpsi for aluminum and 1 Mpsi for titanium. Unsupported films of aluminum oxide, boron carbide, and silicon nitride were prepared by deposition on a copper foil replica of a glass surface and later dissolving the copper. The strengths of these films were between 4 and 27 kpsi. Author (GRA)

N73-22509# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EXOELECTRONIC EMISSION OF METALS AND ALLOYS AND CERTAIN APPLICATIONS OF THE METHOD OF EXOELECTRONIC EMISSION FOR THE INVESTIGATION OF SURFACE PHENOMENA
I. Ya. Dekhtyar, V. V. Philipenko, and A. M. Shalaev 16 Feb. 1973 28 p refs Transl. into ENGLISH from the mono. "Struktura i Svoistva Splavov" Kiev, Izd-vo Naukova Dumka, 1970 p 5-16
(AD-756943; FTD-MT-24-1248-72) Avail: NTIS CSCL 07/4

Surface properties have attracted the attention of physicists and practical workers for a long time. The processes which take place on a surface also affect important characteristics of a substance, such as, emission, catalytic and adhesive properties. The structure and the state of a surface to a significant degree determine the strength characteristics of materials under special conditions. At present, there is no definite viewpoint on the physical nature of the phenomenon, there is no universally recognized theory which would describe in detail exoelectronic emission and the phenomenon connected with it. Thus, the authors examine the viewpoints on the nature of exoelectronic emission which exist at the present time and its connection with various surface phenomenon of metals and alloys. GRA

N73-22510# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MEASUREMENT AND ANALYSIS OF THERMAL INHOMOGENEITIES DEVELOPED DURING THE PLASTIC DEFORMA-

TION OF COPPER
Gerald L. Moss Sep. 1972 211 p refs
(DA Proj. 1T0-61101-A-33E)
(AD-756416; BRL-1610) Avail: NTIS CSCL 11/6

A photon detection system was designed and calibrated for the measurement of thermal changes encountered during the plasticity of metals. Calibrations were made of the thermal response of the detection system, the optical effects of changes in surface topography and changes in the thermal radiating characteristics of a metal that arise during plasticity. Then the radiant energy emitted from electrolytic tough pitch copper during plastic extension was recorded with the photon detection system. Abrupt changes in emission were correlated with the intermittent plastic action of Luders bands. The tendency for plasticity to continue to develop by the functioning of individual Luders bands throughout deformation to fracture was established with radiation measurements. The conversion of mechanical work into heat was considered in terms of dislocation motion and annihilation. Two new models of energy conversion through dislocation annihilation were developed to account for heating. The localized temperature changes developed within Luders bands during plasticity were estimated from the radiation data.
Author (GRA)

N73-22511# Army Materials and Mechanics Research Center, Watertown, Mass.
FATIGUE CRACK PROPAGATION IN AN EXPLOSION-BONDED 2024 ALUMINUM PLATE
John C. Scalzo Nov. 1972 15 p refs
(DA Proj. PEMA)
(AD-756423; AMMRC-TR-72-35) Avail: NTIS CSCL 11/6

Fatigue crack propagation in an explosion-bonded 2024 aluminum plate was studied. The results were used to correlate the results of ultrasonic testing of the bond properties with fatigue properties. A metallographic investigation and a microhardness traverse were also conducted at the bond zone to better evaluate the different bond conditions. A fracture mechanics approach was used to investigate the effect of explosion bonding on fatigue crack growth. Crack growth rates were determined at increasing values of stress intensity factor. Specimens were obtained from areas of the plate which were determined to be bonded with few defects and from areas where it was determined that voids were present at the bond zone. Cracks were made to propagate perpendicular to the bonding direction as well as in the bonding direction and opposing the bonding direction. The test results show crack growth rates on the low side of the range as reported in the literature, with no apparent effect due to either void content or bonding direction. Author (GRA)

N73-22512# Army Foreign Science and Technology Center, Charlottesville, Va.
EFFECT OF TRUE SUPERPLASTICITY DURING TENSIONING
N. Y. Somin, R. K. Aubakirova, and A. A. Presenyakov 20 Dec. 1972 11 p refs Transl. into ENGLISH from Izu. Akad. Nauk Uz. SSR, Ser. Fiz. Mat. Nauk (Tashkent), no. 4, Jul. - Aug. 1970
(AD-756601; FSTC-HT-23-1546-72) Avail: NTIS CSCL 11/6

The concept of superplasticity, as the state of a sample extended by tensile stress to a very high elongation, requires a more precise definition. The final stage of superplastic flow, followed by true superplasticity, is developed under near zero stresses (less than 0.025 kg per mm squared). The experimental data indicates that super-plastic flow is a common phenomenon during plastic deformation of metals and alloys. The appearance and development of superplastic flow in metals and alloys is controlled by numerous factors, which determine whether the phenomenon may appear and may be absent. The development of superplastic flow (moment of its appearance and its duration) is controlled by such factors as preliminary and acting deformation, temperature, and others which promoted its appearance. Author (GRA)

N73-22513# United Aircraft Corp., East Hartford, Conn. Research Labs.
FIBER REINFORCED CERAMIC MATRIX COMPOSITES Final Report, 15 Jan. 1972 - 15 Jan. 1973
J. J. Brennan and M. A. DeCrescente 15 Jan. 1973 74 p refs
(Contract N00019-72-C-0377)
(AD-757063; M911294-4) Avail: NTIS CSCL 11/4

Tungsten reinforced silicon nitride was found to increase the elevated temperature (1300C) Charpy impact strength by a factor of nine over monolithic Si3N4, primarily due to the energy absorbing mechanism of fiber pullout. However, the room temperature Charpy impact strength of tungsten reinforced Si3N4 is not increased over that of monolithic Si3N4 due to the brittle nature of the silicide reaction product at the Si3N4-W interface and the notch sensitivity of tungsten. Tantalum wire reinforced Si3N4 was found to increase the room temperature Charpy impact strength of Si3N4 by a factor of 30 (0.5 ft-lbs to 14.8 ft-lbs) and also to affect the mode of failure such that interfacial splitting along with ductile fiber elongation occurs, resulting in very small fragments of matrix breaking off upon impact. This mode of fracture is desirable for use in gas turbine engines.
Author (GRA)

N73-22514# Pennsylvania State Univ., University Park. Materials Research Lab.
PREPARATION OF METAL-OXIDE-HYDROXIDE PROTECTIVE LAYERS UNDER CONTROLLED pO2-pH2O-T CONDITIONS Final Report, 1 Mar. 1967 - 31 Mar. 1972
Frank Dachille, E. W. White, and Rustum Roy 25 Jan. 1973 16 p refs
(Contract N00014-67-A-0385-0002; NR Proj. 032-502)
(AD-755729) Avail: NTIS CSCL 11/6

The report briefly summarizes research on work concerned with the preparation of oxidation films on metals under various pO2, pH2O, and temperature conditions and the characterization of these films. The thrust of the research was to seek out conditions which would lead to the formation of corrosion resistant oxide or hydroxide films. The metals considered for study were narrowed down to aluminum and iron, along with titanium, nickel and chromium. The principal method for characterization of the corrosion films are soft X-ray spectroscopy, and X-ray diffraction. GRA

N73-22515# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
DISLOCATION DISTRIBUTION IN FATIGUED METALS Final Report
J. Weertman 23 Oct. 1972 11 p refs
(Contract N00014-67-A-0356-0016; NR Proj. 031-725)
(AD-755227) Avail: NTIS CSCL 11/6

Topics included are: Effect of mean stress; Study of single Cu and Cu alloy single crystals; Study of microstructure in vicinity of fatigue crack; and Dislocation tangle formation in silicon iron under cyclic stressing. GRA

N73-22516# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
THE EFFECT OF A THIN DIFFUSED SOLUTE LAYER ON THE NUCLEATION OF FATIGUE CRACKS Progress Report, 1 Oct. 1971 - 1 Oct. 1972
Irwin G. Greenfield and Derle M. Nyder Dec. 1972 59 p refs
(Grant AF-AFOSR-2094-71; AF Proj. 9782)
(AD-755385; TR-162; AFOSR-73-0123TR) Avail: NTIS CSCL 11/6

Small alterations in the surface conditions of Ti-6Al-4V can have significant effects on the fatigue life. A critical amount of dissolved oxygen near the surface was more effective than diffused aluminum. A combination of solute hardening, twin formation and grain boundary effects seems at this time to be the major controlling factor in the surface retardation of the nucleation of fatigue cracks. High vacuum will increase fatigue life greatly. The lifetime in high vacuum appears to be due to the growth of the cracks and not the nucleation process. GRA

N73-22517# Battelle Columbus Labs., Ohio.
ENGINEERING DATA ON NEW AEROSPACE STRUCTURAL MATERIALS, VOLUME 1 Final Summary Report, Apr. 1971 - Jul. 1972
O. L. Deel and H. Mindlin Sep. 1972 133 p refs
(Contract F33615-71-C-1262; AF Proj. 7381)
(AD-755407; AFML-TR-72-196-Vol-1) Avail: NTIS CSCL

11/6

The major objectives of the research program were to evaluate newly developed materials of interest to the Air Force for potential weapons system usage, and then to provide data sheet type presentations of engineering data for these materials. The effort covered in the report has concentrated on 17-4 PH (H900) ESR bar, Udimet 710 forged bar, 7050-T7E56 hand forging, 2214-T351 plate, and Ti-6Al-4V (DBHT) diffusion bonded component. The properties investigated include tension, compression, shear, bend, impact, fracture toughness, fatigue, creep and stress-rupture, and stress corrosion at selected temperatures.
Author (GRA)

N73-22518# Battelle Columbus Labs., Ohio.
ENGINEERING DATA ON NEW AEROSPACE STRUCTURAL MATERIALS, VOLUME 2 Final Summary Report, Apr. 1971 - Jul. 1972
O. L. Deel and H. Mindlin Sep. 1972 184 p refs
(Contract F33615-71-C-1261; AF Proj. 7381)
(AD-755408; AFML-TR-72-196-Vol-2) Avail: NTIS CSCL 11/6

The major objectives of the research program were to evaluate newly developed materials of interest to the Air Force for potential weapons system usage, and then to provide data sheet type presentation of engineering data for these materials. The effort covered in this report has concentrated on 15-5 PH (H1025) forged bar, HP 9Ni-4Co-0.20C forged bar, PH 13-8 Mo (H1000) forged bar, 7049-T76 extrusions, Ti-6Al-2Sn-4Zr-6Mo sheet, Inconel 702 sheet (Aged), and Inconel 706 forged bar (creep-rupture heat treatment). The properties investigated include tension, compression, shear, bend, impact, fracture toughness, fatigue, creep and stress rupture, and stress-corrosion at selected temperatures.
Author (GRA)

N73-22519# Bureau of Mines, Washington, D.C.
DISPERSION STRENGTHENING OF INTERNALLY OXIDIZED IRON-ALUMINUM ALLOYS
Mark I. Copeland (Bur. of Mines, Albany, Oreg.) and William C. McBee (Bur. of Mines, Albany, Oreg.) 1972 22 p refs
(PB-213967-3; BM-RI-7686) Avail: NTIS HC $3.00 CSCL 13H

Dispersion strengthening of iron by internal oxidation and consolidation of Fe-2 wt pct Al powders was studied. Internal oxidation of 650-750C in H2-1.5 vol pct H2O gases, sintering at 900C, and high energy rate extruding at 800C promoted the formation of 0.1-micron Al2O3 particles and dispersion strengthening. The tensile strength, optimizing at 17 Kpsi, at 800C was dependent upon the Al/O weight ratio of the extrusions. The stress-rupture strength was 800C at the better alloys compared with 310 stainless steel.
Author (GRA)

N73-22520# Army Materials and Mechanics Research Center, Watertown, Mass.
COINCIDENCE STRUCTURAL UNIT MODELS FOR GRAIN BOUNDARIES IN HCP METALS
Gordon A. Bruggeman, George H. Bishop, Jr., and William H. Hartt, III Feb. 1972 47 p refs
(DA Proj. 1T0-61102-B-32A)
(AD-756884; AMMRC-TR-72-7) Avail: NTIS CSCL 20/2

Coincidence concepts, commonly used in treating the structures of grain boundaries in cubic metals, are used to develop coincidence structural-unit models for grain boundaries in hcp metals. In doing this the concept of coincidence is extended to one of near-coincidence, in which the shared atoms at the boundary need not occupy exact coincidence sites but instead occupy compromise positions between two nearly coincident lattice sites. This extension allows one to define near-coincidence-site lattices (near-CSL's) from which are derived short-period near-coincidence structural units. Exact and near-CSL's in the common hcp metals are tabulated for rotations about (0001), -1,0,-1,0=, and -1,1,-2,0=, and short-period coincidence structural units are presented. Geometric models of a variety of symmetric and asymmetric -1,0,-1,0= tilt boundaries are developed as examples to show how a relatively few coincidence structural units are combined in the structures of both simple and complex boundaries. Although hcp boundaries are treated here, the approach is quite general and can be applied to any crystal structure.
Author (GRA)

N73-22521# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
REPORT OF THE MATERIALS RESEARCH COUNCIL (1972)
Edward E. Hucke Dec. 1972 105 p ref
(Contract DAHC15-71-C-0253; ARPA Order 0236)
(AD-755585) Avail: NTIS CSCL 11/6

The report provides a summary of the activities and output of the Materials Research Council for the year ending December, 1972. The subject areas discussed are the following: Stress corrosion cracking; Surfaces of IR laser window materials; Gradient materials; Reliability of brittle materials; Prevention of failure from fracture; Materials limitation in advanced energy conversion systems; Structure of stable disordered carbon systems; Strength differential effect; Wave propagation in composites; Materials problems in applications of superconductivity; Fracture mechanics; Structure of non-biological polymers; Thermodynamic properties of materials at very high temperature; Structure of amorphous materials; Solid electrolytes for advanced batteries; Recycling and waste disposal of materials.
GRA

N73-22522# Army Weapons Command, Rock Island, Ill. Weapons Lab.
APPLICATION OF ATOMIC ABSORPTION SPECTROPHOTOMETRY TO THE ANALYSIS OF CHROMIUM STAINLESS STEELS
Elizabeth A. Peterson Dec. 1972 21 p refs
(AD-755809; SWERR-TR-72-85) Avail: NTIS CSCL 11/6

The report describes a method of analysis for chromium in stainless steels by atomic absorption spectrophotometry. Stainless steel samples are dissolved in a HCl-HNO3 mixture and then oxidized with perchloric acid. This solution is fumed until only perchloric acid is left; at this point it is diluted to a known volume and spectroanalyzed. Good agreement was obtained between certified values of NBS stainless steels and the analytical results.
GRA

N73-22523# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EVALUATION OF FATIGUE STRENGTH WITH NON-STATIONARY LANDING
L.V. Konovalov and S. A. Gasparyan 16 Feb. 1973 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Tekhn. Nauk (Erevan), v. 24, no. 3, 1971 p 45-50
(AF Proj. 1467)
(AD-756945; FTD-MT-24-1579-72) Avail: NTIS CSCL 11/6

The report describes a method for evaluating the effect of loading on the fatigue strength of steel.
GRA

N73-22524# Army Foreign Science and Technology Center, Charlottesville, Va.
LAMINATED STEEL
V. S. Ivanova and L. R. Botvina 24 Aug. 1972 12 p Transl. into ENGLISH from Ref. Zh. Met. (Moscow), no. 7, 1970 p 125-130
(AD-756556; FSTC-HT-23-223-72) Avail: NTIS CSCL 11/6

The following properties of laminated steel are discussed: Static strength and macromechanism of fracture; Notch sensitivity; Cyclic strength; Heat resistance.
GRA

N73-22525# Vought Aeronautics, Dallas, Tex.
INVESTIGATION OF SOLID CADMIUM EMBRITTLEMENT IN A-7 AIRCRAFT FAILED SHAFTS AND HORN FRACTURE SURFACES Final Report, 1 Apr. 1972 - 15 May 1973
O. H. Cook, R. E. Duval, C. G. Ford, and R. W. White Jan. 1973 90 p refs
(Contract F33615-72-C-1609; AF Proj. 7381)
(AD-756906; VAC-2-50110/3R-3062; AFML-TR-72-249) Avail: NTIS CSCL 01/3

Solid cadmium embrittlement, which was first discovered as the cause of failures in titanium fasteners, can also cause cracking in high strength steels. The conditions which must be present for initiation of this phenomenon are: there must be intimate contact between the cadmium and steel; the steel must be heat treated to ultimate strength levels of 200 Ksi or over; a tensile stress must act parallel to the surfaces exposed to the cadmium. The A-7 Aircraft horizontal tail actuator shaft and horn assembly meet these conditions; therefore, an investigation was made to determine the possible presence of cadmium as a

contributor to failure on six shaft and one horn fracture surfaces. Author (GRA)

N73-22526# Watervliet Arsenal, N.Y.
RESIDUAL STRESS MEASUREMENT USING SURFACE DISPLACEMENTS AROUND AN INDENTATION
John H. Underwood Dec. 1972 32 p refs
(DA Proj. 1T0-61102-B-32A)
(AD-756869; WVT-7264) Avail: NTIS CSCL 11/6

An experimental method is described which can measure the direction and applied stress in metals. The method uses optical interference to measure the permanent surface deformation around a shallow spherical indentation in a polished area on the metal specimen. The deviation from circularly symmetrical surface deformations is measured at known values of applied stress in calibration specimens. This deviation from symmetry can then be used to determine the direction and magnitude of tensile residual stress in specimens of the same material. Determination of compressive residual stress is more limited. A model of the indentation process is offered which qualitatively describes experimental results in 4340 steel for both tensile and compressive stress. Various conditions are discussed which affect the indentation process and its use to measure stress, including (a) the rigidity of support of the indentor and specimen (b) the size and depth of the indentation (c) the uniaxial stress-strain behavior of the specimen material. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-22527 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EXPERIMENTAL INVESTIGATION OF THE MECHANICAL BEHAVIOR OF A FILLED ELASTOMER AT PRESSURES BELOW .000001 TORR Ph.D. Thesis
Gerald Lee Gregory 1972 217 p
Avail: Univ. Microfilms Order No. 72-27162

This thesis experimentally measured the effects of the vacuum of space on the mechanical behavior of a filled elastomeric spacecraft material. Special emphasis was given to the understanding of those mechanisms by which mechanical properties are changed by the vacuum environment. In addition several existing techniques, which are frequently used in the earth's environment to predict mechanical behavior, were applied to the vacuum results in order to develop a technique which would be useful in predicting the effects of vacuum on filled elastomeric materials. The test program consisted of measuring in situ, in vacuum, the mechanical behavior (tensile creep) of a filled elastomer (solid propellant rocket fuel). The resulting measurements were used to develop a better understanding of the material-environment interactions occurring. Dissert. Abstr.

N73-22528*# Martin Marietta Corp., Denver, Colo.
DEVELOPMENT OF ADVANCED MATERIAL COMPOSITES FOR USE AS INTERNAL INSULATION FOR LH2 TANKS (GAS LAYER CONCEPT) Final Report
J. P. Gille Jul. 1972 131 p
(Contract NAS8-25974)
(NASA-CR-124222; MCR-72-130) Avail: NTIS HC $8.75 CSCL 11D

A program is described that was conducted to develop an internal insulation system for potential application to the liquid hydrogen tanks of a reusable booster, where the tanks would be subjected to repeated high temperatures. The design of the internal insulation is based on a unique gas layer concept, in which capillary or surface tension effects are used to maintain a stable gas layer, within a cellular core structure, between the tank wall and the contained liquid hydrogen. Specific objectives were to select materials for insulation systems that would be compatible with wall temperatures of 350 F and 650 F during reentry into the earth's atmosphere, and to fabricate and test insulation systems under conditions simulating the operating environment. A materials test program was conducted to evaluate the properties of candidate materials at elevated temperatures and at the temperature of liquid hydrogen, and to determine the compatibility of the materials with a hydrogen atmosphere at the appropriate elevated temperature. The materials that were finally selected included Kapton polyimide films, silicone adhesives, fiber glass batting, and in the case of the 350 F system, Teflon film. Author

N73-22529*# Wyle Labs., Inc., Huntsville, Ala.
ACOUSTIC FATIGUE AND SOUND TRANSMISSION CHARACTERISTICS OF A RAM COMPOSITE PANEL DESIGN
J. A. Cockburn, K. Y. Chang, and G. C. Kao Dec. 1972 102 p refs Revised
(Contract NAS8-29146)
(NASA-CR-124079; TM-72-3) Avail: NTIS HC $8.00 CSCL 11D

An experimental study to determine the acoustic fatigue characteristics of a flat multi-layered structural panel is described. The test panel represented a proposed design for the outer skin of a research application module to be housed within the space shuttle orbiter vehicle. The test specimen was mounted in one wall of the Wyle 100,000 cu ft reverberation room and exposed to a broadband acoustic environment having an overall level of 145 db. The test panel was exposed to nine separate applications of the acoustic environment, each application consisting of 250 seconds duration. Upon completion of the ninth test run, the specimen was exposed to a simulated micrometeoroid impact near the panel center. One additional test run of 250 seconds duration was then performed to complete the overall simulation of 50 flight missions. The experimental results show that no significant fatigue damage occurred until the test specimen was exposed to a simulated micrometeoroid impact. The intermediate foam layer forming the core of the test specimen suffered considerable damage due to this impact, causing a marked variation in the dynamic characteristics of the overall test panel. During the final application of the acoustic environment, the strain and acceleration response spectra showed considerable variation from those spectra obtained prior to impact of the panel. Fatigue damage from acoustic loading however, was limited to partial de-bonding around the edges of the composite panel. Author

N73-22530# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md. Coating and Chemical Lab.
CHLORIDE AND WATER PERMEABILITY OF AUTOMOTIVE BRAKE HOSE Final Report
Jules B. Counts and Robert G. Jamison Jul. 1972 32 p refs
(DA Proj. 1T0-62105-A-108)
(AD-748083; CCL-306; Rept-73-00838) Avail: NTIS HC $3.75 CSCL 13/11

The chloride and water permeability of hydraulic brake hoses were determined. Permeability parameters measured were time interval, temperature, type of exposure, type of brake hose composition, type of brake fluid, and the cation linked with the chloride ion. It was found that sufficient chloride and water will permeate brake hoses to initiate corrosion of metal parts in the conventional brake system. Also, the extent of permeability is greatly reduced in systems containing silicone fluids. Author

N73-22531*# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
DEVELOPMENT OF AN EXTERNAL CERAMIC INSULATION FOR THE SPACE SHUTTLE ORBITER. PART 2: OPTIMIZATION Technical Report, 20 Mar. - 20 Nov. 1972
Richard A. Tanzilli, ed. Mar. 1973 129 p refs
(Contract NAS1-10533)
(NASA-CR-112257) Avail: NTIS HC $8.50 CSCL 11D

The basic insulation improvement study concentrated upon evaluating variables which could result in significant near-term gains in mechanical behavior and insulation effectiveness of the baseline system. The approaches undertaken included: evaluation of small diameter fibers, optimization of binder slurry characteristics, evaluation of techniques for controlling fiber orientation, optimization of firing cycle, and the evaluation of methods for improving insulation efficiency. A detailed discussion of these basic insulation improvement studies is presented. Author

N73-22532*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DYNAMIC MEASUREMENT OF BULK MODULUS OF DIELECTRIC MATERIALS USING A MICROWAVE PHASE SHIFT TECHNIQUE
B. J. Barker and L. D. Strand 15 Nov. 1972 17 p refs
(Contract NAS7-100)
(NASA-CR-131743; JPL-TM-33-577) Avail: NTIS HC $3.00 CSCL 11G

A microwave Doppler shift technique was developed for measuring the dynamic bulk modulus of dielectric materials such as solid propellants. The system has a demonstrated time resolution on the order of milliseconds and a theoretical spatial resolution of a few microns. Accuracy of the technique is dependent on an accurate knowledge of the wavelength of the microwave in the sample being tested. Such measurement techniques are discussed. Preliminary tests with two solid propellants, one non-aluminized and one containing 16% aluminum, yielded reasonable, reproducible results. It was concluded that with refinements the technique holds promise as a practical means for obtaining accurate dynamic bulk modulus data over a variety of transient conditions. Author

N73-22533*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A BRIEF SURVEY OF CARBON/CARBON REFRACTORY COMPOSITES AT THE JET PROPULSION LABORATORY
E. Y. Robinson 1 Dec. 1972 19 p refs
(Contract NAS7-100)
(NASA-CR-131745; JPL-TM-33-579) Avail: NTIS HC $3.00 CSCL 11G

Refractory composites of carbon-carbon material are considered for application in: (a) rocket motor nozzles and skirts, (b) a unique integrated propulsion structure, and (c) planetary atmospheric entry shells. Technical developments and plans in each of these areas are described. Author

N73-22534# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PHYSICO-CHEMICAL SURFACE PHENOMENA IN REINFORCED PLASTIC ABLATION
Jean Brulard, Jean Crabol, Guy Engelle, and Claude Verdier 1972 78 p refs In FRENCH; ENGLISH summary
(ONERA-NT-195) Avail: NTIS HC $6.00

Three methods of investigation are presented: dynamic visualization through high-speed motion pictures, chemical analysis of gas sampled at the surface, and micropyrometry. The application of these techniques leads to the conclusion that, in the range of experimental conditions, the boundary layer and the surface are chemically reactive. Author

N73-22535*# Manlabs, Inc., Cambridge, Mass.
INVESTIGATION OF THE FRACTURE MECHANICS OF BORIDE COMPOSITES
Edward V. Clougherty, Richard L. Pober, and Larry Kaufman Sep. 1972 105 p refs
(Contract NASw-2088)
(NASA-CR-131877) Avail: NTIS HC $7.25 CSCL 11D

Significant results were obtained in fabrication studies of the role of metallic additives of Zr, Ti, Ni, Fe and Cr on the densification of ZrB2. All elemental additions lower the processing temperatures required to effect full densification of ZrB2. Each addition effects enhanced densification by a clearly distinguishable and different mechanism and the resulting fabricated materials are different. A significant improvement in strength and fracture toughness was obtained for the ZrB2/Ti composition. Mechanical characterization studies for the ZrB2/SiC/C composites and the new ZrB2/Metal materials produced data relevant to the effect of impacting load on measured impact energies, a specimen configuration for which controlled fracture could occur in a suitably hard testing apparatus, and fracture strength data. Controlled fracture--indicative of measurable fracture toughness--was obtained for the ZrB2-SiC-C composite, and a ZrB2/Ti composite fabricated from ZrB2 with an addition of 30 weight per cent Ti. The increased strength and toughness of the ZrB2/Ti composite is consistent with the presence of a significantly large amount of a fine grained acicular phase formed by reaction of Ti with ZrB2 during processing. Author

N73-22536# Construction Engineering Research Lab. (Army), Champaign, Ill.
FIBER REINFORCED CONCRETE: A GENERAL DISCUSSION OF FIELD PROBLEMS AND APPLICATIONS
B. H. Gray Apr. 1972 14 p
(AD-741358; M-12) Avail: NTIS HC $3.00 CSCL 11/4

Field problems are presented, associated with the use of a concrete containing randomly oriented uniformly distributed short lengths of fibers (fibrous concrete). Mix formulation and field handling characteristics often determine whether a new material is suitable for an application. Any alterations in the standard procedures will be reflected in different uses of the materials. The results of mix formulation and field handling experience with the use of fibrous concrete are presented, and several possible applications are discussed. Author

N73-22537# Construction Engineering Research Lab. (Army), Champaign, Ill.
FIBROUS CONCRETE FOR PAVEMENT APPLICATIONS
B. H. Gray and J. L. Rice Apr. 1972 12 p
(AD-741357; M-13) Avail: NTIS HC $3.00 CSCL 13/3

A new paving material was introduced which provides outstanding performance from thin pavement sections. The material is called fibrous concrete and is composed of conventional portland cement concrete materials with steel fibers randomly dispersed throughout the concrete mass. The material exhibits highly desirable behavioural properties for pavement applications. High first crack strength, ability to carry load after cracking, ability to arrest cracks and high spall resistance and ductility are some of the advantages offered by fibrous concrete over conventional concrete. Two controlled traffic test sections were conducted and the preliminary results are remarkable. Traffic simulating operations of the C-5A cargo aircraft were applied to a 6-in. thick fibrous concrete slab on grade and a 4-in. thick fibrous concrete overlay of a 10-in. thick plain concrete slab. The fibrous concrete thickness represents approximately one half the design thickness of plain concrete necessary to sustain about 4000 simulated repetitions of the C-5A before significant structural damage to the slab occurs. About 8700 repetitions were applied to the 6-in. thick slab on grade and 6900 repetitions were applied to the 4-in. thick overlay pavement. After this volume of traffic, testing was suspended and the only distress evident was a number of hairline width cracks. These cracks would not interfere with normal aircraft operations on an in-use pavement. Author

N73-22538# Oak Ridge Y-12 Plant, Tenn.
STUDIES OF FOAMED EPOXIES
G. F. Dorsey, W. L. Harper, E. A. Larson, and M. K. Morrow 14 Sep. 1972 77 p refs
(Contract W-7405-eng-26)
(Y-1833) Avail: NTIS

Incorporation of cell-stabilizing additives has been applied to the development of low-density epoxy adhesives. Investigation of a large number of organic compounds indicated that the long-chain carboxylic acids yielded the most stable epoxy-polyamide foams and the amines yielded the lowest density foams. Success of the carboxylic acids, especially stearic acid, apparently was due to the stabilizing effect of the salt formed by the fatty acids and the free polyamines present in the curing agents. Consequently, stearic acid-stabilized Epon 828/Versamid 125/Versamid 140 foamed adhesive formulations were developed having pot lives greater than 25 minutes and adhesive tensile strengths on the order of 750 psi for densities of approximately 0.30 gm/cc. Author

N73-22539*# Los Alamos Scientific Lab., N.Mex.
CMB-13 RESEARCH ON CARBON AND GRAPHITE
Progress Report, 1 Nov. 1971 - 31 Jan. 1972
Morton C. Smith Oct. 1972 10 p ref Sponsored in part by NASA
(Contract W-7405-eng-36)
(NASA-CR-131483; PR-20; LA-5062) Avail: NTIS HC $3.00 CSCL 11D

Research and development are reported on phenolic resin binders, coke flour, binder soaking, hot molding glass-like carbons, and particle packing. NSA

N73-22540# Naval Ordnance Lab., White Oak, Md.
EVALUATION OF STABILIZED PRECURSORS FOR HIGH STRENGTH CARBON FIBERS
Charles R. Rowe 30 Nov. 1972 27 p refs
(AD-755427; NOLTR-72-259) Avail: NTIS CSCL 07/3

In order to understand the method of direct graphitization more completely, samples of polyacrylonitrile(PAN) fiber were stabilized at various combinations of temperature, tension, and duration of oxidation. The percent weight loss and chemical composition of each residue were then determined. It was found that chemical analyses and weight loss data of the fiber residue can be used to determine the extent of the stabilization of PAN fibers. Author (GRA)

N73-22541# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.
REINFORCEMENT MECHANISMS IN METAL-MATRIX COMPOSITES Final Report, 7 Dec. 1971 - 7 Dec. 1972
Robert F. Karlak, Francis W. Crossman, and John Grant Dec. 1972 64 p refs
(Contract N00019-71-C-0289)
(AD-756257; LMSC-D313101) Avail: NTIS CSCL 11/4

A finite-element program was composed and tested for analyzing the behavior of unidirectional metal-matrix composites under transverse loads of sufficient magnitude to cause yielding, flow, and failure. A model for filament-matrix interface debonding was designed and used to predict the behavior of transversely loaded unidirectional, 50-v/oB/Al(6061-O and -T6) and Be/Ti (6 Al-4V) when such failure occurs. Brief studies were made of fiber shape (elliptical versus circular) and of plastic-zone growth from yield to failure in B/Al composites. A tensile test on a specially prepared W/Al composite was used to verify one calculation, and fabrication and testing of a Be(ribbon)/Al composite were attempted. Author (GRA)

N73-22542# Drexel Univ., Philadelphia, Pa. Dept. of Metallurgical Engineering.
STRUCTURE, STABILITY, AND MECHANICAL BEHAVIOR OF ALUMINUM-STAINLESS STEEL COMPOSITES
A. Pattniak and A. Lawley Feb. 1973 42 p refs
(Contract N00014-67-A-0406-0001; NR Proj. 031-721)
(AD-756673; TR-9) Avail: NTIS CSCL 11/4

The mechanical behavior of aluminum-stainless steel composites (VF = 6.5% and 19.6%) was studied with particular reference to the role and stability of the interface. In particular, ambient temperature tensile yielding, flow, and fracture were correlated with the associated interface microstructures, matrix substructure, and fracture morphology in the as-pressed condition and following elevated-temperature exposure at 550C or 625C for 24 hours. Author (GRA)

N73-22543# Army Foreign Science and Technology Center, Charlottesville, Va.
THE APPLICATION OF PHENOL-FORMALDEHYDE PLASTIC FOAM AS THERMAL INSULATION FOR SOLAR WATER HEATERS
K. A. Guner, M. Jamalov, and G. Ya. Vmarov 22 Aug. 1972 5 p refs
(AD-756591; FSTC-HT-23-1578-71) Avail: NTIS CSCL 11/7

The purpose of the research is to find methods of improving the efficiency and productivity of a solar heater, reduce its cost and prolong its service life. The authors insulated the floor of the heater with type FRP-I foam plastic on a base of phenol-formaldehyde resin of the resol type. The experiment was conducted in parallel with two water heaters. The first had wood insulation, the second the FRP-I plastic foam. The technique of preparing the thermal insulation is given. GRA

N73-22544# Army Electronics Command, Fort Monmouth, N.J.
RADIATIVE HEAT TRANSFER THROUGH COMPOSITE MATERIALS
I. N. Greenberg and P. G. Klemens (Conn. Univ.) Nov. 1972 16 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-757140; ECOM-4065) Avail: NTIS CSCL 11/4

Radiative heat transfer in inhomogeneous materials is governed by the photon mean free path. For long-wave photons, the mean free path depends on the size and shape of the individual grains and, where applicable, of the voids. Long-wave photons have long mean free paths and play an important role in the heat transfer. In some cases they cause the radiative thermal conductivity at moderately high temperatures to be larger than one would expect by extrapolating from highest temperatures (above 2000K) according to a (T cubed) law. Some special cases are treated including polycrystalline solids, densely packed powders, foams and fibrous aggregates. Author (GRA)

N73-22545# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
THREE-DIMENSIONAL ANALYSIS OF STRESS CONCENTRATIONS NEAR HOLES IN LAMINATED COMPOSITES
Richard M. Barker, Jon R. Dana, and Charles W. Pryor, Jr. (Babcock and Wilcox) Dec. 1972 35 p refs Presented at ASCE Specialty Conf. on Composite Mater. Pittsburgh, 13-14 Nov. 1971
(Contract DAAF07-69-C-0444)
(AD-756454; VPI-E-72-27) Avail: NTIS CSCL 11/4

Stress concentration factors are determined using a three-dimensional finite-element analysis for laminated composites pierced by circular, square and diamond-shaped holes. Both angle-ply and bidirectional laminates are investigated for hole size to width-of-strip ratios from 0.125 to 0.417. Normal stress concentrations are found to be the least for square holes and greatest for diamond-shaped holes. Interlaminar shear stress concentrations, which cannot be determined by a two-dimensional analysis, are as large at the hole surface as those at the free edge when angle-ply laminates are utilized and the holes are large. For small circular holes, angle-ply (plus or minus 45) laminates are recommended. When large holes are present, bidirectional (90/0) laminates are shown to be more efficient.
Author (GRA)

N73-22546# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRIC STRENGTH OF LIQUID DIELECTRICS
I. Balygin 9 Nov. 1972 322 p refs Transl. into ENGLISH of the book "Elektricheskaya Prochnost Zhidkikh Dielektrikov" 1964 p 1-227
(AD-755756; FTD-HC-23-732-72) Avail: NTIS CSCL 11/7

In the report account is given of the contemporary science of electric strength in liquid dielectrics. Experimental and theoretical data are presented on their breakdown. Processes connected with chlorodiphenyl are considered in a way which is useful for conditions which are encountered in application. Data are also presented on the electric strength of insulating mixtures and information on the change in the electrical and physical properties of certain insulation liquids subjected to radiation is also included. Furthermore, consideration is given to questions connected with the spark temperature at the time of an electric breakdown and the pressure in the discharge channel.
Author (GRA)

N73-22547# Horizons Research, Inc., Cleveland, Ohio.
SYNTHESIS OF PHOSPHONITRILIC PLASTICS AND ELASTOMERS FOR MARINE APPLICATIONS Final Technical Report, 5 Jul. 1971 - 4 Nov. 1972
Kennard A. Reynard, Arthur H. Gerber, and Selwyn H. Rose Dec. 1972 50 p refs Sponsored in part by Naval Ship Eng. Center, Hyattsville, Md.
(Contract DAAG46-71-C-0103; DA Proj. 1T0-62105-A-329)
(AD-755188; AMMRC-CTR-72-29) Avail: NTIS CSCL 11/9

The objective of the research was to prepare a family of inexpensive, flame-retardant polyphosphazene plastics and elastomers for use in various marine applications. Eleven different, flame-retardant, relatively inexpensive poly(aryloxyphosphazenes) were prepared. The poly(aryloxyphosphazenes) displayed high flame retardancy in the unfilled, uncured state. The three poly(aryloxyphosphazenes) tested performed very well. Ten of the materials were plastics which were good film formers and most films were flexible, strong and oriented upon drawing. These materials included the ((C6H5O)2PN)n, ((4-ClC6H4O)2PN)n, and ((3-CH3C6H4O)2PN)n homopolymers and the ((4-ClC6H4O)2PN (2,4-Cl2C6H3O)2PN)n copolymer. The polymers also showed good chemical resistance to acids and bases. GRA

N73-22548# Explosives Research and Development Establishment, Waltham Abbey (England).

HEAT AGING OF RUBBERS
A. L. Stokoe Mar. 1972 35 p refs
(AD-755827; ERDE-TR-91; BR-32184) Avail: NTIS CSCL 11/10

The oven aging behavior of six rubbers (nitrile, polychloroprene, PVC/nitrile, fluorocarbon, EPDM and natural), in the form of tensile dumb-bells has been measured and attempts have been made to relate the aging behavior to conventional rate processes. By fitting to an empirical equation ,the change of elongation at break and the prediction of shelf storage life at ambient temperature can be made for all the rubbers except the fluorinated rubber (Viton). Author (GRA)

N73-22549# Aerospace Corp., El Segundo, Calif.
POLYACRYLONITRILE PRECURSOR FIBERS FOR CONVERSION TO HIGH-MODULUS, HIGH-STRENGTH FIBERS. VOLUME 2: MASS THERMAL ANALYSIS Research Report, Oct. 1969 - May 1970
Camille A. Gaulin and Willard R. McDonald 16 Oct. 1972 78 p refs
(Contract F04701-72-C-0073)
(AD-755350; TR-0059(6250-40)-5-Vol-2; SAMSO-TR-72-304-Vol-2) Avail: NTIS CSCL 11/5

The successful conversion of polyacrylonitrile (PAN) fibers to high-strength, high-modulus fibers depends in part on an understanding of the thermal and oxidative reactions of this polymer system. Described is the application of new analytical techniques to identify the dominant chemical reactions that are involved in the transformation of a PAN precursor to a graphitizable carbon fiber. The results indicate that, despite its popular acceptance for many years, the mechanism that postulates intramolecular cyclization to yield a linear ladder polymer has no basis in fact. An interpretation consistent with the present results involves a series of elimination reactions, followed by intermolecular crosslinking and cyclization induced by dipole interactions between pendant nitrile groups. The chemistry of oxidative stabilization of PAN at moderate temperatures is also presented. GRA

N73-22550# Aerospace Corp., El Segundo, Calif.
POLYACRYLONITRILE PRECURSOR FIBERS FOR CONVERSION TO HIGH-MODULUS, HIGH-STRENGTH FIBERS. VOLUME 3: SOME X-RAY DIFFRACTION CONSIDERATIONS Research Report, Nov. 1970 - Jul. 1971
Sam Brelant and Willard R. McDonald 12 Jan. 1973 25 p refs
(Contracts F04701-70-C-0059; F04701-71-C-0172; F04701-71-C-0073)
(AD-755351; TR-0059(6250-40)-5-Vol-3; SAMSO-TR-72-310-Vol-3) Avail: NTIS CSCL 11/5

An attempt was made to utilize Debye-Scherrer X-ray diffraction patterns to demonstrate the relationship between the apparent degree of molecular orientation of polyacrylonitrile precursor and the final graphite crystallite orientation in high-performance graphite fibers. In the case of specially prepared fibers with extremely high orientation followed by crosslinking with ionizing radiation, some retention of orientation was evident throughout all processing steps. The apparent orientation retention, however, was less than that anticipated and inadequate in itself to confirm the postulated mechanism invoking retention of the chain-extended crystal structure through the thermal decomposition. An alternative mechanism of chemical cyclization consistent with the apparent morphology has already been proposed. Author (GRA)

N73-22551# Watervliet Arsenal, N.Y.
METAL MATRIX COMPOSITES FOR HIGH TEMPERATURE APPLICATION
I. Ahmad, J. M. Barranco, W. J. Heffernan, and K. E. Loomis Dec. 1972 105 p refs
(DA Proj. 1T0-62105-A-331)
(AD-756867; WVT-7266) Avail: NTIS CSCL 11/4

This is a second yearly progress report on the project, the objective of which is to develop high strength filaments (tungsten alloys and silicon carbide) reinforced super alloy composites with a rupture life of 100 hours under 30 ksi at 2000F. The report represents progress made in the following three main areas: Fabrication and testing of composites (W alloy filament in modified Mar M-322 alloys); Compatibility and extended period filament-matrix stability at 2000F in the W alloy filament-Mar M-322 (25%W) systems; and Development of a technique for the coating of TaC on filaments of SiC and Tungsten. GRA

N73-22552# Northwestern Univ., Evanston, Ill. Materials Research Center.
[MATERIALS BEHAVIOR, PROPERTIES OF SOLIDS AND POLYMERS, AND HEAT RESISTANT ALLOYS] Annual Technical Report No. 13, 1 Oct. 1971 - 30 Sep. 1972
30 Sep. 1972 224 p refs
(Contract DAHC15-67-C-0213; Grant NSF GH-33575)
(AD-755660) Avail: NTIS CSCL 20/12

The report contains condensed summaries of research activities at the Materials Research Center from October 1, 1971 through September 30, 1972. Topics include: Behavior of materials; Properties of solids and polymers; Mechanical behavior of composite materials; Heat-resistant metals and alloys; Band structures; Semiconductors; Magnetic materials. GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-22553 Ohio State Univ., Columbus.
BI-NORMAL COORDINATES IN DISCRETE SYSTEMS WITH APPLICATION TO AN AIRCRAFT SHIMMY PROBLEM Ph.D. Thesis
Lynn Carroll Rogers 1972 257 p
Avail: Univ. Microfilms Order No. 72-27093

The use of bi-normal coordinate theory in the analysis of practical discrete systems is presented as providing the substantial benefits of conceptual value/physical insight, computational utility, and enhanced redesign capability. These benefits are explained and demonstrated with attention to practical considerations. In particular, the nature of response in a single homogeneous phasor mode is described in detail; also, an expression for the derivative of an eigenvalue is developed and explained. Analysis is made of an aircraft nosegear shimmy problem using bi-normal coordinate methods. Stability boundaries, mode shapes, and sensitivities to parameter changes are presented, in addition to derivatives of eigenvalues to illustrate automated minimum weight design for a shimmy-free nosegear. Recommendations for further research are made. Dissert. Abstr.

N73-22554 Virginia Polytechnic Inst. and State Univ., Blacksburg.
STATISTICAL MODELS FOR FORECASTING Ph.D. Thesis
Frank Charles Fuller 1972 188 p
Avail: Univ. Microfilms Order No. 72-27161

A procedural approach is given to statistical forecast when the information at hand is given in terms of nonstationary time series, not in statistical equilibrium. Three specific stochastic models are involved, namely the autoregressive, the moving average, and the mixed autoregressive-moving average processes. A backward filter method is introduced whereby the above stationary models can be used to model nonstationary information. The above models are attractive with respect to updating and adjusting to forecast 1,2,...,L steps ahead. The proposed procedure was applied to environmental, economics, and communication data. The smoothing of the stochastic models to the above applications resulted in minimum mean square error forecasts. In addition, certain aspects of spectral analysis were used to analyze the environmental data. A brief discussion of the double exponential smoothing method of forecasting is given along with a comparison of the proposed approach to statistical forecasting. Dissert. Abstr.

N73-22555*# Auburn Univ., Ala. Dept. of Mathematics.
FURTHER COMMENTS ON THE APPLICATION OF THE METHOD OF AVERAGING TO THE STUDY OF THE ROTATIONAL MOTIONS OF A TRIAXIAL RIGID BODY, PART 2 Progress Report, 1 Oct. 1971 - 1 Apr. 1972
Joseph J. F. Liu and Philip M. Fitzpatrick 27 Mar. 1973 25 p refs

(Grant NGR-01-003-036)
(NASA-CR-131878) Avail: NTIS HC $3.25 CSCL 12A

The second and final step in the development of first-order secular solutions to rotational motions of triaxial bodies is presented. Author

N73-22556*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
COINCIDENCE DEGREE AND PERIODIC SOLUTIONS OF NEUTRAL EQUATIONS
Jack K. Hale and J. Mawhin (Louvain Univ., Belgium) 19 Apr. 1973 22 p refs
(Grant NGL-40-002-015; AF-AFOSR-2078-71; DA-ARO(D)-31-124-71-G12S2)
(NASA-CR-131887) Avail: NTIS HC $3.25 CSCL 12A

The problem of existence of periodic solutions for some nonautonomous neutral functional differential equations is examined. It is an application of a basic theorem on the Fredholm alternative for periodic solutions of some linear neutral equations and of a generalized Leray-Schauder theory. Although proofs are simple, the results are nontrivial extensions to the neutral case of existence theorems for periodic solutions of functional differential equations. Author

N73-22557*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.
AN ALGORITHM FOR CALCULATION OF THE JORDAN CANONICAL FORM OF A MATRIX
B. Sridhar and D. Jordan Mar. 1973 24 p refs
(Grant NGL-07-002-002)
(NASA-CR-131654; TR-73-1) Avail: NTIS HC $3.25 CSCL 12A

Jordan canonical forms are used extensively in the literature on control systems. However, very few methods are available to compute them numerically. Most numerical methods compute a set of basis vectors in terms of which the given matrix is diagonalized when such a change of basis is possible. Here, a simple and efficient method is suggested for computing the Jordan canonical form and the corresponding transformation matrix. The method is based on the definition of a generalized eigenvector, and a natural extension of Gauss elimination techniques. Author

N73-22558*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH AND APPLICATIONS: ARTIFICIAL INTELLIGENCE Semiannual Progress Report, 2 Oct. 1970 - 31 Mar. 1971
B. Raphael, R. E. Fikes, L. J. Chaitin, P. E. Hart, P. O. Duda, and N. J. Nilsson Apr. 1971 248 p refs
(Contract NASw-2164; SRI Proj. 8973)
(NASA-CR-131593) Avail: NTIS HC $14.50 CSCL 12A

A program of research in the field of artificial intelligence is presented. The research areas discussed include automatic theorem proving, representations of real-world environments, problem-solving methods, the design of a programming system for problem-solving research, techniques for general scene analysis based upon television data, and the problems of assembling an integrated robot system. Major accomplishments include the development of a new problem-solving system that uses both formal logical inference and informal heuristic methods, the development of a method of automatic learning by generalization, and the design of the overall structure of a new complete robot system. Eight appendices to the report contain extensive technical details of the work described. Author

N73-22559# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON SOME NUMERICAL SMOOTHING AND INTERPOLATION METHODS
Claude LeComte and Gerard Faye 1972 22 p refs In FRENCH; ENGLISH summary
(ONERA-NT-205) Avail: NTIS HC $3.75

Various interpolation and smoothing methods are studied including smoothing of a set of equidistant points, adaptation of the same method to the case of nonequidistant points, smoothing based on radii of curvature, interpolation through spline functions, and smoothing through spline functions. A brief survey of these methods and the optimal conditions of their use is included. Author

N73-22560# Rome Air Development Center, Griffiss AFB, N.Y.
SYNCHRONIZATION PROPERTIES OF BINARY, LINEAR, MAXIMAL LENGTH SEQUENCES
Frederick D. Schmandt Jun. 1972 160 p refs
(AD-744101; RADC-TR-72-131) Avail: NTIS HC $10.00 CSCL 12A

The use of binary, linear, maximal length sequences, and their subsequences for synchronization purposes are considered. The various correlation terms are defined and illustrated and techniques for simplifying the correlation calculations are set forth. Based upon these results methods for selecting sequences with good properties are presented. Also, an insight is given into what causes some sequences to have poor properties. Author

N73-22561# Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.
APPROXIMATION AND BOUNDS FOR EIGENVALUES OF VARIOUS DOMAINS USING THE INTERMEDIATE PROBLEM TECHNIQUE
Richard E. Dame Jun. 1972 132 p refs
(Contract N00014-67-A-0377-0003)
(AD-756672; Rept-72-6) Avail: NTIS CSCL 12/1

A variational method was developed to obtain lower bounds for eigenvalues, eigenfunctions and general solutions to problems which have complicated boundary conditions or regional shapes. By using an intermediate-problem approach, field functions were expanded in an infinite Fourier type expansion in a Hilbert space of eigenfunctions of a conveniently related problem. Final solutions are developed by projecting the field function into a subspace which is orthogonal to a given infinite dimensional subspace of constraints. The purpose of the study is to develop a new method which could generate the difficult eigenfunctions and boundary-value problem solutions, since previous investigators have universally limited their developments of the intermediate problem method to eigenvalue determinations. The results of this study, therefore, show that solutions of difficult problems which were not accessible through other means can now be generated efficiently. Author (GRA)

N73-22562# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
LEARNING CONTROL SYSTEMS AND PATTERN RECOGNITION Final Progress Report, 15 Sep. 1967 - 15 Sep. 1972
James W. Moore, Eugene S. McVey, Robert L. Ramey, E. J. White, Edward A. Parrish, Jr., and R. A. Smoak Nov. 1972 296 p refs
(Contract DAAB07-68-C-0066; DA Proj. 1T0-61102-B-81A)
(AD-756424; THEMIS-3375-173-72U; ECOM-0066-6) Avail: NTIS CSCL 12/1

The report covers the five year research effort of this Project THEMIS contract. This report is divided into four sections: each section summarizing the overall developments during the five years plus additions to theory and experiment derived from the final year of research. Section 1 (Academic Progress) summarizes the important contributions made to science and to education as a direct consequence of this Project THEMIS. Section 2 covers studies on man as a learning controller, ideal prediction with a learning system, and the question of stability in learning theories is covered in this section. Section 3 is concerned primarily with the development of both the theories and the experimental techniques of pattern recognition. Section 4 reports on the development and use of photosensitive receptor arrays for pattern recognition. Author (GRA)

N73-22563# Alabama Univ. Research Inst., Huntsville.
COMPUTER PROGRAM FOR SOLUTION OF LARGE, SPARSE, UNSYMMETRIC SYSTEMS OF LINEAR EQUATIONS
John E. Key Aug. 1972 36 p refs
(Contract F44620-69-C-0124; AF Proj. 9560)
(AD-755878; UARI-RR-130; AFOSR-73-0220TR) Avail: NTIS CSCL 12/1

A computer program written in FORTRAN IV symbolic language for the in-core solution of large, sparse, unsymmetric systems of linear equations is presented. The efficiency of this program with respect to computer storage and arithmetic operations depends upon the system of equations at hand and

the technique adopted for selecting the pivotal element are included so that the program user can choose the technique which appears to be suitable for the system of equations under consideration. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-22564 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 128, NO. 10: RESULTS OF THE SYNOPTIC SERVICE DURING 1972. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb, 850 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, OCTOBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 128, HEFT 10: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1972. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 mb, 850 mb), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, OKTOBER]
1972 239 p In GERMAN
Avail: Issuing Activity

Daily and monthly Northern Hemisphere ground level, 500 mb, and 850 mb height and temperature analyses of constant pressure levels for October 1972 are presented, based on rawinsonde and stratospheric rocket sounding data. Corresponding monthly mean maps for the Berlin region, their variations and deviations are included as well as the mean grid point data calculated from daily values. Included brief scientific studies cover smoke cloud indentification in satellite photographs, collection of frequently used equations and constants, and 20 year summary of the Berlin weather map. Transl. by G.G.

N73-22565 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 100, NO. 4: CLIMATOLOGY OF THE STRATOSPHERE IN THE NORTHERN HEMISPHERE. PART 1: HEIGHTS, TEMPERATURES AND GEOSTROPHIC RESULTANT WIND SPEEDS AT 100, 50, 30, AND 10 mb
Karin Labitzke et al 1972 291 p refs
Avail: Issuing Activity

Stratospheric data of the Northern Hemisphere, gathered continually since 1957, is tabulated for the purpose of investigating climatological processes. Analysis of daily weather maps and grid point data, calculation of cold and warm winter mean values, computation of geostrophic winds, and standard deviations all appear in graph and table form. J.M.M.

N73-22566 Pennsylvania Univ., Philadelphia.
A STUDY OF THE ESTIMATION OF THE DISTANCE TO A THUNDERSTORM USING A STATISTICAL SIMULATION OF GROUND WAVE ATMOSPHERICS Ph.D. Thesis
Robert Edwin Lefferts 1972 283 p
Avail: Univ. Microfilms Order No. 72-25614

A computer program was developed for the statistical simulation of lighting return strokes and their associated ground wave atmospherics. The statistical data available on the return stroke was used in an analytical model of the return stroke to calculate the waveform of ground wave atmospherics over a flat perfectly conducting earth. A statistical simulation of a large number of ground wave atmospherics was then performed. The results of this simulation were used to develop an analytical representation for the probability density function of the peak electric field amplitude of the atmospherics (or, equivalently, the waveform at the receiver output) as a function of distance. Using this probability density function, a method for estimating the average distance to a thunderstorm was developed based on the ratio of the number of received signals with peak amplitudes in a few fixed intervals. Dissert. Abstr.

N73-22567*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
TORNADO OCCURRENCES RELATED TO OVERSHOOTING CLOUD-TOP HEIGHTS AS DETERMINED FROM ATS PICTURES
Theodore T. Fujita Apr. 1972 35 p refs
(Grants NGR-14-001-008; NOAA-E-198-68(G))
(NASA-CR-131875; SMRP-RP-97) Avail: NTIS HC $3.75 CSCL 04B

A sequence of ATS 3 pictures including the development history of large anvil clouds near Salina, Kansas, was enlarged by NASA into 8X negatives which were used to obtain the best quality prints by mixing scan lines in 8 steps to minimize checker-board patterns. These images resulted in the best possible resolution, permitting use to compute the heights of overshooting tops above environmental anvil levels based on cloud shadow relationships along with the techniques of lunar topographic mapping. Of 39 heights computed, 6 were within 15 miles of reported positions of 3 tornadoes. It was found that the tornado proximity tops were mostly less than 5000 ft, with one exception of 7000 ft, suggesting that tornadoes are most likely to occur when overshooting height decreases. In order to simulate surface vortices induced by cloud-scale rotation and updraft fields, a laboratory model was constructed. The model experiment has shown that the rotation or updraft field induces a surface vortex but their combination does prevent the formation of the surface vortex. This research leads to a conclusion that the determination of the cloud-top topography and its time variation is of extreme importance in predicting severe local storms for a period of 0 to 6 hours. Author

N73-22568*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
RADIATION MEASUREMENTS FROM POLAR AND GEOSYNCHRONOUS SATELLITES Annual Report, 1 Oct. 1971 - 30 Sep. 1972
Thomas H. VonderHaar Jan. 1973 202 p refs
(Grant NGR-06-002-012)
(NASA-CR-130194) Avail: NTIS HC $12.25 CSCL 04B

During the 1960's, radiation budget measurements from satellites have allowed quantitative study of the global energetics of our atmosphere-ocean system. A continuing program is planned, including independent measurement of the solar constant. Thus far, the measurements returned from two basically different types of satellite experiments are in agreement on the long term global scales where they are most comparable. This fact, together with independent estimates of the accuracy of measurement from each system, shows that the energy exchange between earth and space is now measured better than it can be calculated. Examples of application of the radiation budget data were shown. They can be related to the age-old problem of climate change, to the basic question of the thermal forcing of our circulation systems, and to the contemporary problems of local area energetics and computer modeling of the atmosphere. Author

N73-22569# Institut d'Aeronomie Spatiale de Belgique, Brussels.
INFLUENCE OF BIOSPHERE ON THE ATMOSPHERE [LA BIOSPHERE AU SERVICE DE L'ATMOSPHERE]
Marcel Nicolet 1973 10 p In FRENCH
(Aeronomica-Acta-A-116) Avail: NTIS HC $3.00

Physical and chemical processes responsible for the production of ozone and oxygen in the atmosphere are examined. Particular attention was given to the influence of water vapor dissociation, long wave ultraviolet radiation, and solar radiation on the production of ozone. The role of the biosphere in maintaining the chemical equilibrium of the atmosphere is discussed in detail. Transl. by E.H.W.

N73-22570+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 118, NO. 1: DAILY AND MONTHLY NORTHERN HEMISPHERE 10-MILLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1970, PART 1, JANUARY - MARCH
1972 118 p refs
(Contract DAJA37-72-C-3073)
(QTSR-1) Avail: NTIS HC $8.00

Stratospheric weather maps are presented. Daily height and temperature analysis of constant pressure levels are included for three months for the Northern Hemisphere, based on rawinsonde

and rocketsonde data. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. The stratospheric circulation of polar, middle, and tropical latitudes is described.
Author

N73-22571# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 2, FEBRUARY 1973
19 Apr. 1973 102 p refs Transl. into ENGLISH of Meterol. i Gidrol. (Moscow), No. 2, Feb. 1973
(JPRS-58797) Avail: NTIS HC $7.25

Articles are presented concerning microclimate, agricultural meteorology, and weather forecasting in the U.S.S.R. For individual titles, see N73-22572 through N73-22581.

N73-22572 Joint Publications Research Service, Arlington, Va.
STATISTICAL DESCRIPTION OF THE WIND FIELD IN THE UPPER TROPOSPHERE AND LOWER STRATOSPHERE CONSIDERING THE SCALE OF MOTION c13
N. Z. Pinus and V. A. Shnaydman *In its* Meteorol. and Hydrol., No 2, Feb. 1973 19 Apr. 1973 p 1-17 refs (For availability see N73-22571 13-20)

The statistical characteristic of the wind field for disturbances with time scales of T equal to or less than 6 hours, 6 less than T equal to or less than 72 hours, and 72 hours less than T equal to or less than 720 hours are presented for the two basic seasons of the year for altitudes of 6, 10, and 13 km. The need for more frequent monthly series of rawinsonde observations at a basic world network of aerological stations is discussed.
Author

N73-22573 Joint Publications Research Service, Arlington, Va.
EFFICIENT UTILIZATION OF FORECASTING AND CLIMATOLOGIC INFORMATION WHEN MAKING ECONOMIC DECISIONS
L. S. Gandin and Ye. Ye. Zhukovskiy *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 18-28 refs (For availability see N73-22571 13-20)

A study was made of a simple statistical-economic model for the selection of the optimal strategy for using forecast climatology. It is shown that the strategy for complete confidence in the long-range forecast is optimal only for high accuracy forecasts. For low accuracy of these forecasts, the strategy of ignoring the forecast information and using the climatology is optimal. In addition, for intermediate values of accuracy, the strategy of partial confidence in the forecast is discussed. As an example, the problem of selecting the variety of potato for the forecast temperatures during planting season was investigated. It is demonstrated that for the existing degree of accuracy of such forecasts, their utilization in the given problem is not economically feasible.
Author

N73-22574 Joint Publications Research Service, Arlington, Va.
NUMERICAL FORECASTING OF THE BAROMETRIC FIELD IN THE STRATOSPHERE c13
I. V. Bugayeva and G. R. Zakharov *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 29-39 refs (For availability see N73-22571 13-20)

On the basis of a quasi-geostrophic model of the atmosphere, a forecast is made of the geopotential field of the isobaric surfaces to a level of two millibars for the period of strato-mesospheric warming. Characteristic features of the fields of the meteorological elements during this period are analyzed.
Author

N73-22575 Joint Publications Research Service, Arlington, Va.
TIME-SPACE ANALYSIS OF ASYNCHRONOUS METEOROLOGICAL DATA
Sh. A. Musayelyan and A. F. Khoroshilov *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 40-52 refs (For availability see N73-22571 13-20)

The method is discussed of space-time processing of asynchronous meteorological data based on the solution of the vorticity equation in the quasisolenoidal approximation, linearized with respect to the westerly flow, and as applied to the middle level. The scheme is adapted for reproducing the geopotential field at the 500 millibar surface over the regions of the earth with a sparce aerological observation network. The remote sounding data from meteorological satellites are used as the asynchronous data. The results of numerical experiments using four-dimensional analysis are presented.
Author

N73-22576 Joint Publications Research Service, Arlington, Va.
METHOD OF CALCULATING TURBULENT FLUXES BY THE NETWORK DATA
M. A. El-Shakhovi *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 53-60 refs (For availability see N73-22571 13-20)

A method is proposed for calculating the turbulent fluxes by measuring the meteorological characteristics at a height of two meters. A comparison is made between the results obtained and the calculations of other authors.
Author

N73-22577 Joint Publications Research Service, Arlington, Va.
BLOCKING ANTICYCLONES OVER SIBERIA DURING THE COLD HALF OF THE YEAR AND THE POSSIBILITY OF FORECASTING THEM
V. S. Kalachikova *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 61-68 refs (For availability see N73-22571 13-20)

A study was made of the characteristic features of the pressure fields in the troposphere and stratosphere over the Northern Hemisphere during the development of blocking anticyclones. Considering the Ye. N. Blinova and A. L. Kats circulation indexes, the position of the high-altitude ridges, and using harmonic analysis, the effect of the general circulation on the formation of the blocking anticyclones is demonstrated. Two types of macroprocesses were established for the troposphere preceding the development of blocking anticyclones. Forecasting paramaters of the blocking processes are presented.
Author

N73-22578 Joint Publications Research Service, Arlington, Va.
CLIMATIC VARIABILITY OF THE WINTER WHEAT HARVEST
V. M. Pasov *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 69-81 refs (For availability see N73-22571 13-20)

The variability is analyzed of the winter wheat harvest associated with variations of the weather conditions. The territory is divided into climatic districts. The possible deviations of the harvest from the dynamic mean due to the effect of meteorological conditions are calculated, and probability curves are constructed for each zone.
Author

N73-22579 Joint Publications Research Service, Arlington, Va.
CASE OF VIOLENT TURBULENCE IN THE VICINITY OF KUSTANAY
R. S. Golubov *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 82-84 (For availability see N73-22571 13-20)

The occurrence is described of very violent clear air turbulence on the night of 27 July 1971, in the vicinity of Kustanay during the passage of a cold front, causing intensification of the wind in the ground layer.
Author

N73-22580 Joint Publications Research Service, Arlington, Va.
DURATION OF THUNDERSTORMS OVER THE TERRITORY OF THE USSR
T. V. Lobodin *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 85-90 refs (For availability see N73-22571 13-20)

The thunderstorm duration map for the U.S.S.R. was constructed according to the data of 1,400 meteorological stations. Nomograms are presented for calculating the annual values of the thunderstorm duration. A significant spottiness of the values of the measurements is noted especially in the mountain regions.
Author

N73-22581 Joint Publications Research Service, Arlington, Va.
AN EXPERIMENT IN STUDYING THE NATURE OF THE VARIATION IN INTENSITY OF PRECIPITATION FALLING FROM STRATIFORMIS AND CUMULUS CLOUDS
V. S. Antonov *In its* Meteorol. and Hydrol., No. 2, Feb. 1973 19 Apr. 1973 p 91-96 ref (For availability see N73-22571 13-20)

The results are discussed of studying the variation in maximum intensity of precipitation falling from stratiform and cumulus clouds. It is demonstrated that the precipitation intensity during rain which falls from cumulonimbus clouds associated with a front varies with hourly periodicity. Author

N73-22582# National Weather Service, Silver Spring, Md.
NUMERICAL WEATHER PREDICTION ACTIVITIES NATIONAL METEOROLOGICAL CENTER, SECOND HALF 1972
Mar. 1973 42 p refs
Avail: NTIS HC $4.25

The numerical weather prediction activities of the National Meteorological Center for the second half of 1972 are summarized. High points of the period include: (1) the establishment of the Data Assimilation Branch, Development Division, to study four-dimensional data assimilation, (2) the planetary boundary layer model running experimentally once a day 7 days a week to 24 hours, (3) a global analysis and 12-hr forecast system running twice a day at 10 hours after data time, and (4) the incorporation of satellite vertical temperature profile radiometer data into the operations on December 19, 1972. Also included are summaries of recent developments in data automation and verification statistics for the 6L PE model. Author

N73-22583*# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
USE OF METEOROLOGICAL SATELLITE OBSERVATIONS IN WEATHER MODIFICATION PROGRAMS
A. S. Dennis, P. L. Smith, Jr., and K. R. Biswas Apr. 1973 32 p refs
(Grant NGL-42-001-004)
(NASA-CR-131876; Rept-73-6) Avail: NTIS HC $3.75 CSCL 04B

The potential value of weather satellite data in field operations of weather modification is appraised. It was found that satellites could play a useful role in operational weather modification projects, particularly in the recognition of treatment opportunities. Satellite cloud photographs and infrared observations appear promising in the identification of treatment opportunities in seeding orographic cloud systems for increased snowpack, in seeding convective clouds for increased rainfall, in identifying hail threats, and in tracking and observing hurricanes as an aid to timing and location of seeding treatments. It was concluded that the potential value of satellite data in the treatment and evaluation phases of operational projects is not as great as in the recognition of treatment opportunity. Author

N73-22584*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF HIGH ALTITUDE AIR QUALITY USING AIRCRAFT
Richard A. Rudey and Porter J. Perkins 13 Jun. 1973 15 p refs Proposed for presentation at Intern. Conf. on the Environ. Impact of Aerospace Operations in the High Atmosphere, Denver, 11-13 Jun. 1973; sponsored by Am. Inst. of Aeron. and Astronaut. and the Am. Nucl. Soc.
(NASA-TM-X-68221; E-7422) Avail: NTIS HC $3.00 CSCL 04B

The minor atmospheric constituents associated with and affected by aircraft exhaust emissions at altitudes from 6 to 20 km will be monitored in flight programs presently being implemented. Preliminary in situ data are available from flight tests of dedicated instruments to be used in these programs. A Global Atmospheric Sampling Program using Boeing 747 airliners was determined to be feasible in studies conducted by airlines and airframe companies. Worldwide monitoring in the troposphere and the lower stratosphere is planned. Stratospheric air sampling on a more local basis will be done with a U2 aircraft. Measuring system evaluations and improvements have been required to detect the low background levels. Author

N73-22585# National Weather Service, Silver Spring, Md. Techniques Development Lab.
SYNOPTIC CLIMATOLOGICAL STUDIES OF PRECIPITATION IN THE PLATEAU STATES FROM 850-, 700-, AND 500-MILLIBAR LOWS DURING SPRING
August F. Korte, Donald L. Jorgensen, and William H. Klein Aug. 1972 133 p refs
(NOAA-TM-NWS-TDL-48) Avail: NTIS HC $8.75

The synoptic climatology of precipitation over the Plateau States or intermountain region of the western part of the United States during spring, associated with 850-, 700-, and 500-mb Lows, is derived using 12-hr precipitation amounts (expressed as a percent of the 7-day normal) for 13 yr at 157 stations. The precipitation is initially related to nearby Low centers through a computer grid system of moving coordinates, resulting in precipitation patterns around each Low. Probabilities of precipitation from each upper Low are derived for 35 stations. The use of the derived charts as forecast aids is discussed. It is found that precipitation appears to be specified best by the most intense Lows at the 700-mb level and that the spring season data differ significantly from those of the winter season. Considerable variability is shown to exist among several stations. Author

N73-22586# Environmental Protection Agency, Washington, D.C.
AIRCRAFT EMISSIONS: IMPACT ON AIR QUALITY AND FEASIBILITY OF CONTROL
[1972] 106 p refs
(Rept-72-02452) Avail: NTIS HC $7.50

The present and predicted nature, extent, and control of air pollution related to aircraft operations in the U.S. were studied. The methodology for impact assessment, and the results of impact evaluation are discussed along with the technological feasibility of controlling aircraft emissions, and emission control. It is concluded that: (1) Aircraft emissions are significant contributors to pollution. (2) Airports exert localized impact on air quality. (3) Aircraft emissions and nonaircraft sources must be controlled at airports to comply with the National Ambient Air Quality Standards. Techniques for controlling aircraft emissions are listed. F.O.S.

N73-22587# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Mar. 1972 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX BULLETIN MENSUEL, MARS 1972]
Mar. 1972 28 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiolog.
Avail: NTIS HC $3.50

Data obtained at Belgian weather stations in March 1972 are tabulated. The air pollution apparatus is briefly described. ESRO

N73-22588# Institut Royal Meteorologique de Belgique, Brussels.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Jan. 1972 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, JANVIER 1972]
1972 32 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Synoptic measurements made at different Belgian weather stations in January 1972 are presented. ESRO

N73-22589# Institut Royal Meteorologique de Belgique, Brussels.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Feb. 1972 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, FEVRIER 1972]
1973 32 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Synoptic measurements made at different Belgian weather stations in February 1972 are presented. ESRO

N73-22590# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Apr. 1972 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX BULLETIN MENSUEL, AVRIL 1972]
Apr. 1972 28 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS HC $3.50

Data obtained at Belgian weather stations in April 1972 are tabulated. The air pollution apparatus is briefly described. ESRO

N73-22591# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Jan. 1973 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, JANVIER 1973]
Jan. 1973 16 p In FRENCH and DUTCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during January 1973 are given. ESRO

N73-22592# Naval Postgraduate School, Monterey, Calif.
A STUDY OF A SEVERE LOCAL STORM OF 22 APRIL 1971 M.S. Thesis
Charles E. Horsewell Sep. 1972 71 p refs
(AD-756571) Avail: NTIS CSCL 04/2

A study was made of a severe storm that occurred on 22 April 1971 southeast of Norman, Oklahoma. The life cycle of the storm from origin, through mature stage, to eventual incorporation into a squall line was analyzed. The cell displayed all of the characteristics of a severe local storm, including a hook echo, echo-free vault, sloping overhang, funnel and movement 20 degrees to the right of the mean tropospheric wind. Mesoscale circulations at low and middle levels during the severe stage were revealed by aircraft measured winds. Aircraft meteorological parameter measurements showed the vertical structure and extent of the low-level moist layer. Three-dimensional storm structure at the time a funnel was sighted was inferred from WSR-57 radar antenna tilt sequences and airborne RDR-1 radar RHI profiles. Author (GRA)

N73-22593# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
EXTREMES OF HYDROMETEORS AT ALTITUDE FOR MIL-STD-210B. SUPPLEMENT: DROP-SIZE DISTRIBUTIONS
Paul Tattelman and Norman Sissenwine 20 Oct. 1972 15 p refs
(AF Proj. 8624)
(AD-756832; AFCRL-AFSIG-253; AFCRL-TR-73-0008) Avail: NTIS CSCL 04/2

In the basic report for this supplement, estimates were provided for extreme rainfall intensities and associated liquid water content at altitude with 0.1 and 0.5 percent probabilities in the most severe month in the rainy tropics. Analagous values were also included for two all-time record rain storms: one for 1 min, and the other lasting 42 min. In this brief supplement, drop-size distributions are developed for the 1-min record, and the 0.1 and 0.5 percent Worst Month Tropics from a theoretical expression that best fits the available empirical size distributions. Liquid water content obtained from an integral of this theoretical expression is compared to the liquid water content obtained by arithmetically adding the volumes of each drop for three drop-size distributions. Author (GRA)

N73-22594# General Motors Corp., Goleta, Calif. Delco Electronics Div.
REMOTE AUTOMATIC MULTIPURPOSE STATION Final Technical Report, 1 Jun. 1971 - 31 Dec. 1972
B. M. Buck 31 Dec. 1972 5 p refs
(Contract N00014-71-C-0357; ARPA Order 1783; NR Proj. 307-340)
(AD-756682) Avail: NTIS CSCL 04/2

After two decades of broad spectrum scientific research by the U.S. in the Arctic Ocean and peripheral seas, the need for remote automatic stations to collect data has become obvious. The problem is to develop an unmanned station that can be easily deployed; collect satisfactory data without human presence; be reasonably inexpensive, have a useful life, and be adaptable to a wide variety of input sensors. A study was conducted to determine the best approach to the system which was called LORAMS (Long Range Automatic Measuring Station). The basic concept that was derived employed an HF telemetry link, a digital recirculating memory to store data during polar HF blackouts, and a power supply. The design goals were for one year unattended life and a 1000 n. mile effective range. GRA

N73-22595# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DURATION AND UNUSUAL EXTREMES OF COLD, SUPPLEMENT 1
Irving I. Gringorten 1 Dec. 1972 14 p ref
(AF Proj. 8624)
(AD-756478; AFCRL-72-0705; AFCRL-AFSIG-250) Avail: NTIS CSCL 04/2

The study supplements Duration and Unusual Extremes of Cold, AD-710 611 dated 26 June 1970. It presents revised values of low-temperature extremes that correspond to recently modified guidance on acceptable risk. A low temperature of -50 degrees F corresponds to the value that equipment will encounter with a 50 percent probability when it is exposed in small record-making cold basins of Siberia during the coldest month. The 50 percent probability level is now applicable to operation of equipment. Associated with this extreme is a 1-month cycle of temperatures that are characteristic of the complete thermal regime in which a minimum of -50 degrees F is imbedded. When not in operation, equipment must be able to withstand temperatures in the -81 to -88 degree F range for 1 hour, and below -29 degrees F for 32 days. Author (GRA)

N73-22596# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DYNAMICS OF A SYMMETRIC LARGE-SCALE ATMOSPHERIC VORTEX OF LOW INTENSITY
V. S. Purganskii 12 Feb. 1973 22 p ref Transl. into ENGLISH from the publ. "Tsentralnaya Aerologicheskaya Observatoriya. Trvdy" 1970 p 71-83
(AD-756096; FTD-MT-24-1164-72) Avail: NTIS CSCL 04/2

The paper discusses the development of a model of a symmetric large scale atmospherical whirl described by a nonlinear system of hydrodynamic equations with equations of motion free of addends containing vertical wind velocity components. A procedure for solving this system is presented. The solution can be used in obtaining meteorological information from satellite data on spiral cloud banks when large scale cloud systems extend along air flow fields. Author (GRA)

N73-22597# Chicago Univ., Ill. Lab. for Atmospheric Probing.
PREPRINTS OF PAPERS TO BE PRESENTED AT THE RADAR METEOROLOGY CONFERENCE
Richard W. Fetter, Kenneth W. Haag, John J. Eyink, Gregory J. Hill, and Helen C. Supert 12 Jul. 1972 68 p refs Conf. held at Champaign, Ill., 10-12 Oct. 1972
(Contract N00014-67-A-0285-0014; Grants DA-ARO(D)-31-124-71-G71; NSF GA-27680)
(AD-755438; TR-7) Avail: NTIS CSCL 04/2

Contents: Evaluation of a dual-wavelength radar hail detector; Doppler radar structure of the melting zone and ground clutter effects on Doppler velocity; Doppler turbulence measurements in an evaporating stalactite cloud base zone; Radar observations of intense undulance in an evaporating cloud layer; Radar measurement of the atmospheric turbulence structure function; Incoherent radar measurement of atmospheric turbulence; The effects of a finite radar pulse volume on turbulence measurements; Inverse problem in the theory of turbulence filtering by the radar pulse volume; Meteorological structure of thin clear air scatter layers observed by ultra-high resolution radar; An analysis of coexistent waves and turbulence near clear air echoes; Uncertainties in coherent measurement of the mean frequency and variance of the Doppler spectrum from meteorological echoes.
Author (GRA)

N73-22598# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
SOLID-STATE LASER MULTIWAVELENGTH IDENTIFICATION AND DISPLAY SYSTEM
Stuart A. Schleusener (N. Mex. State Univ., Las Cruces) and Kenneth O. White Jan. 1973 20 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-755161; ECOM-5473) Avail: NTIS CSCL 04/2

A high-speed system for making simultaneous wavelength-dependent transmission measurements on as many as four different wavelengths from a long-pulse solid-state laser has been developed. The new system can make simultaneous on and off (reference) absorption line measurements in absorption cell tests in a period of microseconds, thereby reducing effects of changes in cell optical conditions. An associated dual parameter analyzer contour mode display can present visual transmission data at

any two chosen wavelengths for real-time observation purposes. A proposed system usage of in situ high-speed atmospheric transmission measurements is also presented in which reduction of turbulence effects can be expected, due to the simultaneous measurements. This will be of importance in measuring air pollutants where turbulence affects the concentration. GRA

N73-22599# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12801 LANCE, MISSILE NO. 2149, ROUND NO. 180 EET (22 DECEMBER 1972) Meteorological Data Report
Dec. 1972 44 p
(DA Proj. 1T6-65702-D-127)
(AD-755772; DR-753) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12801 Lance, Missile Number 2149, Round Number 180 EET, are presented in tabular form. Author (GRA)

N73-22600# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A COMPOSITE MESOSCALE CUMULONIMBUS BUDGET Atmospheric Science Paper
Alan K. Betts May 1972 60 p refs
(Contract N00014-68-A-0493-0002; Grant NSF GA-11637)
(AD-755485; AS-Paper-186) Avail: NTIS CSCL 04/2

Composite maps from 950 mb to 150 mb of relative wind field, mixing ratio (r), equivalent potential temperature (theta sub E) and temperature perturbation for the growth and decay phases of a mean mesoscale cumulonimbus system were constructed using radar and one rawinsonde (experiment VIMHEX) for days with similar synoptic scale wind field. Mass flows into the mean system give vertical mass transports for growth and decay phases, and net mass balance. The net convergence of r closely balances a mean surface rainfall per echo and the net enthalpy source by the cumulonimbus system. Fluxes of theta sub E into and out of the system for 5 K ranges confirm energy conservation, and give updraft, downdraft transports. The mesoscale transports are related to the large-scale modification of the mean atmosphere using a theoretical cumulonimbus model. The large scale vertical motion is computed as a residual from the temperature and water vapour budgets. Suitably averaged, the large scale and cumulonimbus mass transports are similar but not identical. It is concluded that a parametric model of cumulonimbus convection in terms of mass transport is quite realistic above the surface 150 mb, where the effects of horizontal variations between updraft and downdraft dominate. GRA

N73-22601# Environmental Technical Applications Center (Air Force), Washington, D.C.
AN OPERATIONAL DECISION MODEL EMPLOYING OPERATIONAL AND ENVIRONMENTAL FACTORS
Dana P. Hall Nov. 1972 24 p refs
(AD-755403; USAFETAC-TN-72-8) Avail: NTIS CSCL 04/2

The model discussed in the paper combines conditional climatological probabilities, climatological probabilities, and operational loss values for specified actions in a manner to make the best operational decision. A sample scenario is given and demonstrated using a hypothetical problem of airlift supply. Author (GRA)

N73-22602# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
CUMULUS CONVECTION AND LARGER SCALE CIRCULATIONS. PART 1: A PARAMETRIC MODEL OF CUMULUS CONVECTION
Raul Erlando Lopez Jun. 1972 108 p refs
(Grants NSF GA-19937; NSF GI-31460)
(PB-213623-2; Paper-188) Avail: NTIS HC $3.00 CSCL 04B

As a tool in the investigation of the interaction of cumulus convection with the large-scale circulation, a numerical time-dependent model was developed that can simulate the entire life-cycle of different types of cumuli under different environmental conditions. The model is basically one-dimensional and parametric. The clouds are assumed to consist of two regions; a protected core and an exposed surrounding shell. The entire depth of the cloud is numerically simulated for each of these mutually interacting regions. The mixing between cloud and environment is parametrized in terms of the turbulence intensity of the interior and exterior of the cloud. The internal circulation of the clouds is parameterized in terms of the one-dimensional velocity field of the core. Author (GRA)

N73-22603# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
CUMULUS CONVECTION AND LARGER SCALE CIRCULATIONS. PART 2: CUMULUS AND MESOSCALE INTERACTIONS
Raul Erlando Lopez Jun. 1972 73 p refs
(Grant NSF GA-19937)
(PB-213624-0; Paper-189) Avail: NTIS HC $3.00 CSCL 04B

A numerical model of individual convective clouds was used to investigate the effects of a typical population of cumulus clouds on the large-scale features of a tropical disturbance. The typical cloud population was determined from radar and synoptic data. Results show that the detrainment of cloud mass from the population produces a net cooling of the air around the clouds. This occurs because the cooling produced by the evaporation of the detrained cloud liquid-water overcompensates the detrainment of sensible heat excess. The typical cumulus population also induces a descending motion in the environment in which the clouds are embedded in order to compensate for the net upward mass-transport of the clouds. The induced subsidence results in the warming and drying of the environment of the clouds. The warming resulting from the induced sinking motion is compensated by the net cooling resulting from detrainment plus the cooling resulting from infrared radiational losses. Similarly, the dryness resulting from the induced subsidence is compensated by the detrainment of water vapor and liquid water from the clouds. Author (GRA)

N73-22604# Utah State Univ., Logan. Water Research Lab.
ON SITE DIGITAL ACCUMULATION AND STORAGE OF HYDROLOGIC DATA FOR USE IN DATA ACQUISITION SYSTEMS Final Report
Duane G. Chadwick 30 Jun. 1972 32 p refs
(Contract DI-14-31-0001-3245; Proj. A-011-Utah)
(PB-214185-1; PRCWRRI-21-1) Avail: NTIS HC $3.00 CSCL 04B

Methods are discussed for measuring wind, water, and temperature, and recording the information in digital form at some given location remote from conventional 110 volt power source. Measurements of wind direction, wind miles, water level, rain fall, temperature, and the happening of miscellaneous events can all be recorded on standard 8-hole paper tape. The system is operable for several months, unattended. The data are recorded at precise predetermined intervals. Dry cell batteries supply the necessary power to operate the system. Author (GRA)

N73-22605# Weather Wing (3rd), Offutt AFB, Nebr.
SYNOPTIC FEATURES ASSOCIATED WITH MODERATE AND HEAVY SNOW FOR LORING AFB, MAINE
Limon E. Fortner, Jr. and Paul Mulder Feb. 1973 16 p refs
(AD-756881; Rept-3WW-TN-73-1) Avail: NTIS CSCL 04/2

The table for event frequency for moderate and heavy snow and the charts presented in the note were prepared from data extracted from the Loring AFB, ME, hourly surface observations tape and the historical map tapes. Average Map Displays (AVMAPS) were prepared for 1000 mb, 850 mb, 700 mb and 500 mb for moderate to heavy snow cases associated with an initial surface wind from the northeast quadrant or the southeast quadrant. Author (GRA)

N73-22606# McGill Univ., Montreal (Quebec). Stormy Weather Group.
INVESTIGATION OF CLOUD AND PRECIPITATION PHYSICS BY RADAR Final Report, 1 Dec. 1965 - 28 Feb. 1972
J. S. Marshall 1 Mar. 1972 39 p refs
(Contract F19628-69-C-0107; AF Proj. 8620)
(AD-755401; AFCRL-TR-73-0020) Avail: NTIS CSCL 04/2

Significant developments in instrumentation directed toward the optimum use of radar in investigations of cloud and precipitation physics were accomplished. A new technique in film display of radar information provides intensity maps in conformal map form. This display, called AZLOR, compliments the standard PPI display with detail and conformity to the true

pattern in small areas. The technique of pulse compression was devised and employed in selected weather situations. A body of microwave attenuation statistics was accumulated from AZLOR records of severe storms. Data were accumulated and analyzed to relate precipitation seen by radar to cloud seen by photography. Radio-located lightning flashes were related to precipitation by radar. A new technique was explored to extrapolate radar precipitation measurements to the surface for comparison with rain gauges. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-22607*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF LANDING VISIBILITY AT AIRPORTS
V. A. Gavrilov and V. I. Goryshin Washington NASA Apr. 1973 13 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 153, 1964 p 18-23
(Contract NASw-2482)
(NASA-TT-F-14887) Avail: NTIS HC $3.00 CSCL 17G

The problem of changing from meteorological visibility range, measured by the M-37 atmospheric transmittance indicator, to the real visibility range of a landing strip, measured by the pilot when landing is discussed. The characteristics of the atmospheric transmittance indicator are described. An example of a typical installation is presented. Author

N73-22608*# TRW Systems Group, Redondo Beach, Calif.
COMPETITIVE EVALUATION OF FAILURE DETECTION ALGORITHMS FOR STRAPDOWN REDUNDANT INERTIAL INSTRUMENTS Final Report
James C. Wilcox Apr. 1973 169 p refs
(Contract NAS8-27335)
(NASA-CR-124234; TRW-18313-6004-RU-00) Avail: NTIS HC $10.50 CSCL 17G

Algorithms for failure detection, isolation, and correction of redundant inertial instruments in the strapdown dodecahedron configuration are competitively evaluated in a digital computer simulation that subjects them to identical environments. Their performance is compared in terms of orientation and inertial velocity errors and in terms of missed and false alarms. The algorithms appear in the simulation program in modular form, so that they may be readily extracted for use elsewhere. The simulation program and its inputs and outputs are described. The algorithms, along with an eight algorithm that was not simulated, also compared analytically to show the relationships among them. Author

N73-22609# Joint Publications Research Service, Arlington, Va.
INERTIAL NAVIGATION
A. N. Balyasnikova 12 Apr. 1973 26 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), no. 1, Jan. 1973
(JPRS-58722) Avail: NTIS HC $3.50

Articles are presented on computing the rotor potential of an electrostatic gyroscope, stability of the stationary motions of a gyroscope with spring limiters on a rotating platform in a Newtonian central field of forces, on the error of a pendulum with a vibrating suspension, and on an algorithm for determining the position of a moving object. For individual titles, see N73-22610 through N73-22613.

N73-22610 Joint Publications Research Service, Arlington, Va.
COMPUTING THE ROTOR POTENTIAL OF AN ELECTROSTATIC GYROSCOPE
A. N. Balyasnikova, A. M. Korovkin, and Ye. M. Pevzner *In its* Inertial Navigation 12 Apr. 1973 p 1-8 refs (For availability see N73-22609 13-21)

The problem of the determination of a rotor potential of an electrostatic gyroscope is considered, based on motions of the rotor that are arbitrary with respect to direction and small in relation to the clearance between the electrode and the rotor. A classification of systems of electrodes is proposed, which makes it possible to determine the general properties of a particular system. In accordance with the proposed classification, conditions are derived for provision of a zero potential of the rotor for systems of electrodes that differ wih respect to geometry. Author

N73-22611 Joint Publications Research Service, Arlington, Va.
STABILITY OF THE STATIONARY MOTIONS OF A GYROSCOPE WITH SPRING LIMITERS ON A ROTATING PLATFORM IN A NEWTONIAN CENTRAL FIELD OF FORCES
A. I. Gurin *In its* Inertial Navigation 12 Apr. 1973 p 9-15 refs (For availability see N73-22609 13-21)

The stability of stationary (steady-state) motions of a gyroscope on a rotating platform in a central field of gravity is investigated by the Raus-Rumyantsev method. The necessary and adequate conditions of stability of the three steady-state motions of the gyroscope were obtained. Author

N73-22612 Joint Publications Research Service, Arlington, Va.
ON THE ERROR OF A PENDULUM WITH A VIBRATING SUSPENSION
V. P. Nesterenko *In its* Inertial Navigation 12 Apr. 1973 p 16-19 refs (For availability see N73-22609 13-21)

It is demonstrated that in consideration of finite rigidity in the stretching of the rod of a pendulum an additional component of the dynamic error originates, caused by the vibration of the point of suspension of the pendulum. Author

N73-22613 Joint Publications Research Service, Arlington, Va.
ALGORITHM FOR DETERMINING THE POSITION OF A MOVING OBJECT
S. A. Filaretova *In its* Inertial Navigation 12 Apr. 1973 p 20-24 refs (For availability see N73-22609 13-21)

The derivation of an algorithm for the determination of the position of a moving object by inertial navigation methods is considered. It is demonstrated that in the realization of the algorithm obtained, no numerical instability originates with a low level of the specialized computing device installed on the object. Author

N73-22614*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES-AIDED INERTIAL NAVIGATION WORK - THE FIRST TWO YEARS OF PROGRESS
Gerald L. Smith Apr. 1973 21 p refs
(NASA-TM-X-62199) Avail: NTIS HC $3.25 CSCL 15G

A description of work whose broad objective is to attain improved aircraft navigation performance through exploitation of the concept of combining navigation data from several sources in an optimum manner is presented. The system developed as a result of the work, called RAINPAL (Recursive Aided Inertial Navigation for Precision Approach and Landing) is designed to combine precision radio range measurements with data from on-board inertial sensors to achieve precision navigation for approach and landing. The paper describes RAINPAL and the rationale of its design, and also serves as a sort of planning document, including a progress report, a summary of objectives past and present, and an exposition of reasons for doing the work. Author

N73-22615*# Texas Instruments, Inc., Dallas.
ATS-1/ATS-3 DUAL SATELLITE NAVIGATION STUDY Final Report, Apr. - Oct. 1970
W. M. Hoover Jan. 1971 220 p refs
(Contract NAS5-21163)
(NASA-CR-130213; TI-U-03-835300-F) Avail: NTIS HC $13.00 CSCL 17G

A study which illustrated the feasibility of implementing an on-board aircraft navigation system based on using the ATS-1 and ATS-3 satellites, the modified Omega Position Location Equipment (OPLE) Control Center, and a suitable aircraft terminal was conducted. The report provides: (1) a consideration of the problems of satellite navigation and an objective definition of the optimum system under the constraints of its specified components, (2) a description of the necessary modifications to the OPLE Control Center, the design of an aircraft terminal, and the design of ground reference terminals, and (3) an outline of

an experiment plan and an estimate of the cost to be expected in conducting the program. Author

N73-22616# Systems Control, Inc., Palo Alto, Calif.
VORTAC ACCURACY STUDY
J. S. Tyler and J. C. Bobick Feb. 1972 46 p
(Contract W1-72-0785-1)
Avail: NTIS HC $4.50

The VORTAC accuracy that is required in order to support the wide range of present and anticipated future operational uses of this system were studied. This work has been carried out to support the RTCA SC-121 by providing a number of tradeoff curves that relate route separations (cross-track, along-track, and vertical) to system errors for the different operational uses of VORTAC. The use of these tradeoff curves is illustrated by specifying the system accuracy that is necessary for particular route width requirements such as: (1) 3.5 n. mi. route width from 20 n. mi. to 40 n. mi. from an LGS airport, (2) 3 n. mi. route width out to 35 n. mi. from a single runway LGS or ILS airport, and (3) 5 n. mi. route width for high density enroute areas, (4) 1,000 ft. vertical separation, and (5) 2,000 ft. vertical separation. Author

N73-22617# Beukers Labs., Inc., Hauppauge, N.Y.
DIFFERENTIAL OMEGA MONITORING AND ANALYSIS, VOLUME 1 Final Report
Ronald L. Ruth and Christian B. Williams 19 May 1972 84 p refs
(Contract DOT-CG-22165-A)
(AD-756024; BLI-FR-3514-Vol-1; DOT-CG-22165A-FR-I-Vol-1)
Avail: NTIS CSCL 17/7

The purpose of this study was to obtain data on the achieved accuracies of Differential Omega. Phase data on three Omega stations was collected over a two month period and analyzed to obtain the positioning accuracies. The equipments used were the Beukers Laboratories LO-CATE WO Processors which track 3 Omega stations on 13.6 kHz. The final report covers the test objectives and plan, the data flow and computation methods along with a summary of results and observations.
Author (GRA)

N73-22618# Beukers Labs., Inc., Hauppauge, N.Y.
DIFFERENTIAL OMEGA MONITORING AND ANALYSIS. VOLUME 2: A. PROGRAM LISTINGS. B. OUTPUT DATA SUMMARIES Final Report
Ronald L. Ruth and Christian B. Williams 19 May 1972 244 p
(Contract DOT-CG-22165-A)
(AD-756025; BLI-FR-3514-Vol-2;
DOT-CG-22165A-FR-II-Vol-2) Avail: NTIS CSCL 17/7

The purpose of this study was to obtain data on the achieved accuracies of Differential Omega. Phase data on three Omega stations was collected over a two month period and analyzed to obtain the positioning accuracies. The equipments used were Beukers Laboratories LO-CATE WO Processors which track 3 Omega stations on 13.6 kHz. Volume II contains FORTRAN listings of the programs used in the data reduction and analysis and the output data summaries. Author (GRA)

N73-22619# Beukers Labs., Inc., Hauppauge, N.Y.
DIFFERENTIAL OMEGA MONITORING AND ANALYSIS. VOLUME 3: ANALOG CHARTS Final Report
Ronald L. Ruth and Christian B. Williams 19 May 1972 262 p
(Contract DOT-CG-22165-A)
(AD-756026; BLI-FR-3514-Vol-3;
DOT-CG-22165A-FR-III-Vol-3) Avail: NTIS CSCL 17/7

The purpose of this study was to obtain data on the achieved accuracies of Differential Omega. Phase data on three Omega stations was collected over a two month period and analyzed to obtain the positioning accuracies. The equipments used were the Beukers Laboratories LO-CATE WO Processors which track 3 Omega stations on 13.6 kHz. Volume III contains the analog plots which are the result of the data analysis. Author (GRA)

N73-22620# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.
AN INVESTIGATION OF ADVANCED PILOTS VERTICAL DISPLAY TECHNIQUES Final Report, Jun. 1971 - Jul. 1972
John L. McDade 29 Jan. 1973 450 p refs
(Contract N62269-71-C-0574)
(AD-755739; NORT-71-295-2) Avail: NTIS CSCL 17/7

The report summarizes the results of a one-year investigation of advanced vertical display techniques. The purpose of the study was to appraise the relative merits of nonconventional display techniques for their potential application aboard a 1985 era naval all-weather day/night attack aircraft. The vertical display system (VDS) must present situation, command, and multisensor (radar, FLIR and TV) information to the pilot and systems requirements were defined including informative, functional and human factors, and VDS performance and design criteria were established. Two mission plans and scenarios were prepared to cover a wide range of aircraft flight conditions and weapon delivery modes to exercise the various avionics sensor systems and establish the worst case or most demanding VDS information and design requirements. A weighting factor tradeoff analysis was conducted to determine the optimum scanning standards and the system design specifications for a complete VDS DIGISPLAY system. A preliminary design for the recommended VDS was prepared and a series of simulation tests were conducted to verify the performance and flyability of the recommended design. Author (GRA)

N73-22621# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
AIR TRAFFIC CONTROL SYSTEM INTERFERENCE CONSIDERATIONS Final Report
F. Tabor and J. Shields Mar. 1972 55 p refs
(Contract DOT-FA70WAI-175)
(AD-755646; FAA-RD-72-20) Avail: NTIS CSCL 17/7

The FAA Air Traffic Control Navigation/Communications system is examined to identify areas within the system that are particularly susceptible to radio frequency interference effects. The identified areas are investigated in the light of known past and present analyses, and recommendations for further studies are made. The report concludes that the cosite aspects of the FAAVHF communications system require further study in order to derive a practical means for achieving electromagnetic compatibility in the future. Author (GRA)

N73-22622# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BEARINGS AND SUSPENSION FOR GYROSCOPIC DEVICES (SELECTED CHAPTERS)
M. P. Kovalev 8 Feb. 1973 156 p Transl. into ENGLISH from the book "Opory i Podvesy Giroskopicheskikh Ustroistv" Moscow, Izd-vo Mashinostr., 1970 169 p
(AD-756337; FTD-MT-24-1670-72) Avail: NTIS CSCL 17/7

Contents: Equations of motion and certain problems of accuracy in gyroscopic instruments; Loads and vibrations in the supports of gyroscopic instruments; Rigidity of gyroscopic roller bearings. GRA

N73-22920* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
QUARTZ GYRO MANUFACTURING AND MEASURING
John R. Rasquin *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 37-43 (For availability see N73-22915 13-34)
CSCL 17G

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-22623*# Scientific Translation Service, Santa Barbara, Calif.
ON THE UTILIZATION OF THERMONUCLEAR PROPULSION FOR AN UPPER STAGE OF THE EUROPA 3 LAUNCHER
P. Blanc Washington NASA Apr. 1973 23 p Transl. into ENGLISH of "Sur l'Utilisation de la Propulsion Nucleo-Thermique

pour un Etage Superieur du Lanceur EUROPA 3", paper presented at Intern. Astronaut. Congr., 23d, Vienna, 8-15 Oct. 1972 Vienna, Intern. Astronaut. Federation, 1972 22 p
(Contract NASw-2483)
(NASA-TT-F-14874) Avail: NTIS HC $3.25 CSCL 21F

A thermonuclear propulsion stage intended to ensure the transfer and injection into geosynchronous equatorial orbit of a space vehicle initially placed in low orbit by the Europa 3 launch vehicle is discussed. The propulsion system would consist of an orthocylindrical core of minimum specific mass comprised of a bed of porous spherules, with a specific impulse between 800 and 820 sec. The fuel will be uranium monocarbide, which would heat cold hydrogen to high temperature prior to its discharge as the propellant. A suitable configuration is described, and operating procedures are outlined. Author

N73-22624*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY PLAN FOR TESTING A THERMIONIC REACTOR IN THE PLUM BROOK SPACE POWER FACILITY
Fred A. Haley [1972] 24 p refs
(NASA-TM-X-68224; E-7427) Avail: NTIS HC $3.25 CSCL 18I

A preliminary plan is presented for testing a thermionic reactor in the Plum Brook Space Power Facility (SPF). A technical approach, cost estimate, manpower estimate, and schedule are presented to cover a 2 year full power reactor test. Author

N73-22625*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXFILE: A PROGRAM FOR COMPILING IRRADIATION DATA ON UN AND UC FUEL PINS
John T. Mayer, Roger L. Smith, Michael B. Weinstein, and Harry W. Davison May 1973 53 p refs
(NASA-TM-X-68226; E-7420) Avail: NTIS HC $4.75 CSCL 18J

A FORTRAN-4 computer program for handling fuel pin data is described. Its main features include standardized output, easy access for data manipulation, and tabulation of important material property data. An additional feature allows simplified preparation of input decks for a fuel swelling computer code (CYGRO-2). Data from over 300 high temperature nitride and carbide based fuel pin irradiations are listed. Author

N73-22626# Naval Research Lab., Washington, D.C. Reactor Materials Branch.
FRACTURE SAFETY CONSIDERATIONS FOR HANFORD-N REACTOR COOLANT PIPING MATERIAL
R. A. Gray, Jr. and F. J. Loss 16 Aug. 1972 16 p refs
(Contract AT(49-5)-2110; AEC MIPR ERG-41004)
(AD-748590; NRL-7439; Rept-73-00837) Avail: NTIS HC $3.00

A proposal was made to lower the temperature of makeup injection water in the Hanford-N reactor coolant piping to achieve a more economical operation. A second proposal calls for freezing a plug of water in a large diameter pipe to permit valve repairs. Implementation of either proposal enforces a degradation in fracture toughness since the latter is temperature dependent. The toughness of A106-B and A212-B pipe materials was characterized by the dynamic tear test procedures. The toughness trends evolved were used to assess the fracture safety of the proposed operations. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-22627 Rice Univ., Houston, Tex.
STUDIES IN SCATTERING: LIGHT SCATTERING FROM A REACTIVE EULERIAN FLUID AND ELECTRON SCATTERING FROM ATOMIC HYDROGEN Ph.D. Thesis
Dwayne Lee Knirk 1972 420 p
Avail: Univ. Microfilms Order No. 72-26439

There are two scattering studies described. The first is a thermodynamic calculation of the spectrum of light scattered from a reacting fluid. The second is a numerical solution of close coupled equations for the scattering of an electron by atomic hydrogen. Dissert. Abstr.

N73-22628 St. Louis Univ., Mo.
OPTICAL CONTRAST LOSS BY AEROSOL IN DOWNWARDLY DIRECTED ATMOSPHERIC PHOTOMETRY Ph.D. Thesis
Patrick Joseph Breitline 1972 111 p
Avail: Univ. Microfilms Order No. 72-23903

A visible light radiative transfer model is developed which can be used to compute daylight radiance, transmittance and contrast within a small solid angle element less than 2 pi x 0.0001 steradian, in a cloudless atmosphere for a variety of sun angles, downward looking angles, altitudes, surface reflectances and atmospheric conditions. This fast running computer model can be used to simulate atmospheric effects in the design of photographic and electro-optical sensor systems. A measurement program is described which resulted in the measurement of the parameters which define the optical environment between a ground target and an airborne optical sensor. The data from the program were used to verify the validity of the transfer model. Dissert. Abstr.

N73-22629 California Univ., Los Angeles.
HYPERSONIC ATTENUATION IN THE VICINITY OF THE SUPERFLUID TRANSITION OF LIQUID HELIUM Ph.D. Thesis
Daniel Edwin Commins 1972 92 p
Avail: Univ. Microfilms Order No. 72-25765

The attenuation of first sound waves has been measured in liquid helium at a frequency of 1 GHz. The results confirm those obtained earlier by the same method and those obtained from the Brillouin spectrum of scattered light. They can be described in terms of three regions: (1) the normal fluid region above 2.3 K where the attenuation is attributed to the classical losses associated with viscosity and thermal conduction; (2) the critical region between 2.0 K and 2.3 K, where the attenuation has a sharp peak occurring near T sub lambda and (3) the superfluid region where the attenuation shows a broad maximum centered at 1.5 K and which is in agreement with the Khalatnikov-Chernikova theory. When 1 GHz results are compared with the Brillouin scattering results, it is found that the attenuation scales as omega squared over the whole temperature range with the possible exception of the data below 1.5 K and in the immediate vicinity of T sub lambda. Dissert. Abstr.

N73-22630*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRONIC OPTICAL TRANSFER FUNCTION ANALYZER Patent Application
Edwin E. Klingman, III, inventor (to NASA) Filed 24 Apr. 1973 15 p
(NASA-Case-MFS-21672-1; US-Patent-Appl-SN-354060) Avail: NTIS HC $3.00 CSCL 20F

An electronic optical transfer function analyzer is described which employs an entirely electronic image dissection system to scan an image produced by an optical system under test, and produce an output signal representative of the intensity of the scanned image element. Repetitive scans and averaging can be used to improve the signal to noise ratio for the measurement. The system may be used with visible light, other electromagnetic radiation, and charged particle beam systems. NASA

N73-22631*# Scripta Technica, Inc., Washington, D.C.
INFRARED DISPERSION FILTERS
N. A. Borisevich NASA May 1973 16 p ref Transl. into ENGLISH from Priroda (Moscow), no. 11, Nov. 1972 p 8-14
(Contract NASw-2484)
(NASA-TT-F-14838) Avail: NTIS HC $3.00 CSCL 20F

New infrared solid state dispersion filters, consisting of powders of metal carbonates, sulfates, chlorides, tungstates, molybolates, as well as various oxides and crystals were developed. The properties of these stable filters are described. Author

N73-22632# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
DETERMINATION OF ABSORPTION AND SCATTERING COEFFICIENTS FOR NONHOMOGENEOUS MEDIA. 2: EXPERIMENT
W. G. Egan, T. Hilgeman, and J. Reichman Apr. 1973 38 p refs Submitted for publication
(RE-451J) Avail: NTIS HC $4.00

Separation of the scattering contribution from the total optical attenuation is necessary to determine the absorption portion of nonhomogeneous media such as naturally occurring minerals. In order to investigate experimentally the applicability of a previously developed two-flux radiative transfer model which takes into account surface reflections and collimated incidence, pulverized and sintered scattering standards prepared from a glass of known absorption coefficient variation were measured. The new model produces an accuracy improvement up to a factor of 2.5 over the Kubelka-Munk theory. Off-axis scattering measurements were made with improved instrumentation between 0.33 and 2.7 micrometers. The model was then applied to the mineral rhodochrosite in this range to obtain accurate values of scattering and absorption. Author

N73-22633# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
DETERMINATION OF ABSORPTION AND SCATTERING COEFFICIENTS FOR NONHOMOGENEOUS MEDIA. 1: THEORY
J. Reichman Apr. 1973 25 p refs Submitted for publication
(RE-452J) Avail: NTIS

Equations are derived to determine the diffuse reflectance and transmittance of inhomogeneous materials. The equations are valid for collimated incident radiation for any angle of incidence. The effects of boundary reflectance and anisotropic scattering are included. The equations are derived from the equation of radiative transport, using the Schuster-Schwartzchild approximation. They are sufficiently simple to be used for spectroscopic determination of the absorption and scattering coefficients. Numerical comparison with more exact solutions of the equation of radiative transfer show very good agreement for all cases except for reflectance in the highly anisotropic case where agreement is only fair. Author

N73-22634*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CONSTRAINED OPTIMIZATION OF IMAGE RESTORATION FILTERS
T. E. Riemer and C. D. McGillem 1973 8 p refs
(Grant NGL-15-005-112)
(NASA-CR-131588; LARS-022573) Avail: NTIS HC $3.00 CSCL 20F

A linear shift-invariant preprocessing technique is described which requires no specific knowledge of the image parameters and which is sufficiently general to allow the effective radius of the composite imaging system to be minimized while constraining other system parameters to remain within specified limits. Author

N73-22635# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RAREFIED GAS PROBING BY ELECTRON BEAM APPLIED TO AERODYNAMIC FLOWS Ph.D. Thesis - Paris Univ., Jun. 1972
Serge Lewy 1972 33 p refs In FRENCH; ENGLISH summary
(ONERA-Publ-146) Avail: NTIS HC $3.75

Rarefied gas probing by electron beam consists in making a thin, high energy electron beam cross the medium under study. The characteristics of the light emission thus produced permit determination of several parameters of the gas in its initial state. This method is particularly fruitful for analyzing hypersonic flows in air or nitrogen. Visualization of thin sections of the flow is obtained either from the light directly emitted on the electron beam path, or also, in pure nitrogen, thanks to the secondary phenomenon of afterglow. For measuring densities analysis of secondary effects permits satisfactory accuracy. The determination of vibration distributions provides interesting results on freezing effects. Lastly, a precise and very simple analysis method of rovibronic bands leads to a fast computation of the rotational temperature. Author

N73-22636*# Naval Weapons Center, China Lake, Calif. Physics Div.
THE INFLUENCE OF DEFECTS AND IMPURITIES ON THE NUCLEATION AND GROWTH OF ORIENTED FILMS BY EVAPORATION
A. K. Green Washington NASA Apr. 1973 61 p refs
(Grant NGR-05-030-001)
(NASA-CR-2234) Avail: NTIS HC $3.00 CSCL 20L

The influence of substrate imperfections on the nucleation and growth of fcc metals on alkali halides is discussed. Films deposited on well characterized substrates under well defined vacuum evaporation conditions are investigated. The experimental results of this work are correlated with similar work by other investigators. Models which have been proposed by various authors to explain experimental results are critically examined and areas of difficulty are pointed out. The influence of defects on nucleation rate and the orientation of the film is emphasized. Specific examples of impurity effects, irradiation effects and the influence of amorphous layers are discussed in detail. Evidence is shown that the formation of multiply twinned particles is a result of coalescence and growth. The only consistent model for the orienting influence of impurities is shown to be a chemical reaction effect. It is demonstrated that an alkali metal impurity is very likely responsible for the orienting influence of both water vapor exposure and irradiation. A negative result is found for the reported possibility of an orienting influence being transmitted through an amorphous layer. Author

N73-22637# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
ON THE IMPULSIVE MOTION OF AN ELECTRICALLY CONDUCTING SLAB IN A MAGNETIC FIELD
J. A. Steketee Mar. 1972 30 p
(VTH-169) Avail: NTIS HC $3.50

The electromagnetic induction phenomena in an electrically conducting infinitely extended plane slab of constant thickness placed in a uniform magnetic field are considered. Initially the slab is at rest and the magnetic field perpendicular to it. The slab is then set in motion with a constant velocity. It is shown that transverse electromagnetic waves are emitted from the faces of the slab to satisfy the boundary conditions. ESRO

N73-22638# Raytheon Co., Waltham, Mass. Research Div.
EXPERIMENTATION AND INVESTIGATION OF OPTICAL IRRADATION-INDUCED SURFACE DAMAGE IN OPTICALLY NONLINEAR MATERIALS Final Report, 1 May 1970 - 31 Oct. 1972
Michael Bass and David W. Fradin Feb. 1973 192 p refs
(Contract F19628-70-C-0223; ARPA Order 1434; AF Proj. 4645)
(AD-756486; S-1505; AFCRL-72-0714) Avail: NTIS CSCL 20/6

Surface and unambiguous bulk damage to optically transparent materials have been studied both experimentally and theoretically. One of the most important conclusions reached to date is that the intrinsic laser-induced damage process is characterized by a probability for damage at each incident power density. This is in contrast to the previously held view that there was a threshold power density which divided damaging levels from those which would do no damage. A model for the damaging process, based on the probability measurements and electron avalanche breakdown, has been devised. In its simplest form, this model has successfully explained the most important properties of the measured damage probability in over 10 different materials. Electron avalanche breakdown, essentially in its dc limit, has been identified as the damaging interaction between 1.06 and 0.69 micrometer radiation and transparent alkali halide crystals. Author (GRA)

N73-22639# Pennsylvania State Univ., University Park. Dept. of Physics.
STIMULATED AND SPONTANEOUS SCATTERING Technical Report, 1 Mar. 1972 - 28 Feb. 1973
T. A. Wiggins 28 Feb. 1973 71 p refs
(Contract N00014-67-A-0385-0012)

(AD-757082) Avail: NTIS CSCL 20/6

Presented are the following reports on stimulated and spontaneous scattering: Sound speeds and laser induced damage in polystyrene; Forward stimulated thermal Rayleigh scattering; Frequency shifts in stimulated Rayleigh wing scattering; Hypersound speeds in sulfur hexafluoride; Measurement of the mutual diffusion constant of hydrogen in methane by means of spontaneous light scattering. GRA

N73-22640# Naval Research Lab., Washington, D.C.
DIFFRACTION OF SOFT X-RAYS BY TWO SUCCESSIVE GRATINGS
Pierre Jaegle 13 Feb. 1973 8 p refs Transl. into English from Compt. Rend. (France), v. 245, 1957 p 1412-1415
(AD-757014; NRL-Trans-1263) Avail: NTIS CSCL 20/6

The spectra of soft X rays having wavelengths greater than about 20 A have been studied by means of optical gratings with grazing incidence. Concave gratings are generally used for this. It seems possible to increase the resolving power of the spectrograph by using two gratings in series. Indeed, the use of two plane gratings increases the dispersion without increasing the diffraction efficiency (concave gratings offer better efficiency), but concavity introduces aberrations which modify the distribution of light in the final image. In order to make an attempt at predicting the effect of adding a second grating, the authors have undertaken a calculation of these distributions using a point source whose rays follow paths close to the plane of the Rowland circle. Author (GRA)

N73-22641# Naval Postgraduate School, Monterey, Calif.
STATISTICAL STUDY OF SOUND SPEED IN THE INHOMOGENEOUS UPPER OCEAN Ph.D. Thesis
James Richard Fitzgerald Dec. 1972 129 p refs
(AD-756570) Avail: NTIS CSCL 20/1

The statistics of the fluctuations of the in-situ speed of sound in the upper ocean have been studied by analyzing the instantaneous phase difference of the output of two hydrophones separated by one meter for sounds of frequency 15 to 151 kHz. The experiment was conducted at 11 ft in water of depth 60 ft in low sea states at night. Comparison of the speed calculated from the time averaged phase difference, with the speed given by velocimeter or empirical relations, yielded differential speeds which deviate by 1 m/sec to 8 m/sec from the accepted values, for frequencies less than 100 kHz. Correlation and spectral analysis of the sound phase and ocean height fluctuations has shown the close relation between these two parameters. There is strong evidence of the presence and importance of bubbles in all of the results, particularly of a large population resonant in the frequency range 56.3 to 71.1 kHz (radius 50 to 60 microns). Author (GRA)

N73-22642# Panametrics, Inc., Waltham, Mass.
ULTRASONIC MEASUREMENT OF PHASE AND GROUP VELOCITY USING CONTINUOUS WAVE TRANSMISSION TECHNIQUES Final Report, 24 May - 4 Nov. 1972
Lawrence C. Lynnworth, Emmanuel P. Papadakis, and Warren R. Rea Jan. 1973 57 p refs
(Contract DAAG46-72-C-0186; DA Proj. 1W0-62113-A-661)
(AD-756385; AMMRC-CTR-73-2) Avail: NTIS CSCL 14/2

Phase and group velocities V and U, respectively, were measured in the 100:1 frequency range 50 kHz to 5 MHz using longitudinal and shear ultrasonic continuous waves in Teflon and in a dispersive three-dimensional reinforced composite. A new transmission approach was developed which used broadband transducers and a pair of wedges to obtain V by a differential path, fixed frequency technique, and to obtain U by fixed-path, differential frequency technique. The path or frequency was incremented to fit additional whole wavelengths in the path, as indicated by 2pi phase shifts in a Lissajous pattern. Cross-checks between U and V confirmed the validity of the approach at least for the two materials investigated. Author (GRA)

N73-22643# Naval Ordnance Lab., White Oak, Md.
A BEAM FOCUSING OPTICAL SYSTEM
Charles J. Albers, Jr. 15 Oct. 1972 69 p refs
(ORD 405/002/092-1/U-175423)
(AD-757008; NOLTR-72-237) Avail: NTIS CSCL 20/6

A beam focusing optical system composed of an elliptical primary mirror and a parabolic secondary mirror is investigated using geometrical optics. Design equations are developed and conclusions from ray tracings are given. The data from the ray tracings, as well as the ray tracing computer program, are also included. Author (GRA)

N73-22644# Lockheed Missiles and Space Co., Palo Alto, Calif. Engineering Science Lab.
DEGRADATION OF COLD OPTICAL SYSTEMS BY CRYODEPOSITION. REPORT FOR 1971 INDEPENDENT PROGRAM
C. K. Liu 5 Feb. 1972 74 p refs
(AD-756772; LMSC-D266319) Avail: NTIS CSCL 07/4

The work reported here represents the first year effort on one part of a research program dealing with transient degradation and contamination of optical materials on orbiting spacecrafts. The present investigation concerned itself with the degradation of the optical system performance as a result of decreased transmission, scattering of out-of-field energy, decreased reflectance of mirrors and increased reflectance of black surfaces caused by the cryodeposition of condensible gases and the debris cloud formed by particulate and gaseous constituents. Pertinent information was collected to identify the possible contaminants associated with the spacecraft environment. A study was also conducted for the radiative characteristics of solid cryodeposit on transparent and opaque substrate. Cryodeposition tests have also been conducted with specific contaminants to determine the degradation of a sensor performance. GRA

N73-22645# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
GUERAP: GENERAL UNWANTED ENERGY REJECTION ANALYSIS PROGRAM USER'S MANUAL
Tien S. Chou 5 Oct. 1972 128 p refs
(Contract F04701-71-C-0377)
(AD-755353; UERTD-TM-3366-008;
SAMSO-TR-72-314-Vol-1) Avail: NTIS CSCL 20/6

The report documents a significant new optical system analysis tool, the General Unwanted Energy Rejection Analysis Program (GUERAP). This CDC 6600 FORTRAN computer code is able to efficiently and accurately measure the off-axis rejection characteristics of a given optical system or baffle. It is applicable to a wide spectrum of systems, such as radiometers, star trackers and sensors, optical system baffles, optical test chambers, spacecraft sun and earth shields, etc. In addition to being a powerful off-axis rejection analysis tool, the GUERAP can also be used to evaluate on-axis image quality for most optical systems, including those with very complex geometry, and for the evaluation of the effect of both internal and external emission energy on infrared systems. Author (GRA)

N73-22646# ILC Technology, Inc., Sunnyvale, Calif.
HIGH POWER ALKALI VAPOR LAMPS Final Report, 5 Mar. 1971 - 29 Sep. 1972
Lowell Noble and Carl Kretschmer Jan. 1973 88 p refs
(Contract N00014-71-C-0183; ARPA Order 306)
(AD-755213; R-ILC-72-31) Avail: NTIS CSCL 20/6

The objective of the work was to develop and deliver prototype 6.4 kW (input power) alkali vapor lamps that would emit 2 kW of output radiation in the major pumping bands of Nd:YAG laser material. The lamps were to be 8 inches long and 18 mm or less in outside diameter, and were to provide an operational lifetime of 100 hours or more. Author (GRA)

N73-22647# Northwestern Univ., Evanston, Ill. Dept. of Physics.
DEVELOPMENT OF INFRARED SENSITIVE PHOTOCONDUCTORS Final Report
R. J. Cashman 6 Dec. 1972 19 p
(Contract NObsr-89232; SF0060502)
(AD-755224) Avail: NTIS CSCL 20/6

Three automatic bias controls were developed for use with silicon photovoltaic cells when operated with background flux present. One of these completely eliminates signal degradation even under very high background intensities. The transistorized version could be greatly improved by using field effect transistors and other recent developments in circuitry to reduce the noise level. Measurements were made of various properties of germanium photovoltaic diodes. The number at hand was small

but all of them indicated that the degradation in signal with high background flux appears to increase with cell sensitivity. Automatic back-biasing appears necessary for optimum noise equivalent power. Author (GRA)

N73-22648# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVERAGING OF THE FLUCTUATIONS OF A SPHERICAL WAVE OVER THE RECEIVING APERTURE
A. I. Kon 30 Jan. 1973 12 p. refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radiofiz. (Kiev), v. 12, no. 1, 1969 p 149-152
(AF Proj. 1279)
(AD-756928; FTD-HT-23-1862-72) Avail: NTIS CSCL 20/6

If a light source is in a turbulent medium or at a short distance from a turbulent layer, then the incident wave cannot be considered as plane, and in all calculations it is necessary to consider its spherical property. The problem which is of practical interest, dealing with the incidence of a wave which passed through a turbulent layer on an elongated objective, was solved in a previous paper only for a plane wave. In this work the results of the previous paper are generalized for the case of a spherical wave. GRA

N73-22649# Army Foreign Science and Technology Center, Charlottesville, Va.
TOTAL ELECTRICAL CHARGE AND MASS OF ELLIPTIC UNIVERSE
R. A. Asanov 21 Dec. 1972 6 p refs Transl. into ENGLISH from Teor. i Mat. Fiz. (USSR), v. 6, no. 3, 1971 p 335-337
(AD-756902; FSTC-HT-23-2081-72) Avail: NTIS CSCL 20/10

It is shown that the total charge, momentum, and mass of an elliptical universe equal zero. GRA

N73-22650# Stanford Univ., Calif. Microwave Lab.
RESEARCH STUDIES ON TUNABLE OPTICAL PARAMETRIC OSCILLATORS Final Report, 1 Jan. 1970 - 30 Sep. 1972
Stephen E. Harris Oct. 1972 12 p refs
(Contract F19628-70-C-0057; AF Proj. 6100)
(AD-756910; SU-ML-2104; AFCRL-72-0648) Avail: NTIS CSCL 20/6

The report briefly summarizes progress of work on tunable optical parametric oscillators and techniques for the generation of ultraviolet and vacuum ultraviolet radiation. GRA

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-22651 New York Univ., N.Y.
ALPHA-SPALLATION CROSS SECTIONS AT 920 MeV (230 MeV/N) IN Al-27, O-16, C-12, AND Be-9, AND APPLICATION TO COSMIC RAY TRANSPORT Ph.D. Thesis
Jonathan Robert Radin 1972 129 p
Avail: Univ. Microfilms Order No. 72-21534

Thin sandwich targets were exposed in the external 920-MeV alpha particle beam at the 184-in cyclotron. First, the cross section for the primary beam-monitor reaction, C-12 (alpha, alpha n) C-11, was determined by exposing sandwiches of plastic scintillator and 100 micron L4 pellicles to the beam. The beam flux was determined from a scan of the vertical tracks in the pellicle. Second, cross sections for the production of F-18 in Al-27; O-15, N-13, C-11, Be-7 in O-16; Be-7 in C-12; and Be-7 in Be-9 were measured. Third, the results were generalized to cover all of the alpha-spallation cross sections in the L (3 much smaller than Z much smaller than 5) and M (6 much smaller than Z much smaller than 9) groups and were applied to an analysis of the effect of the He/H + He ratio of the interstellar gas on the cosmic ray transport phenomena. Dissert. Abstr.

N73-22652 George Washington Univ., Washington, D.C.
A TWO FLUID COSMOLOGICAL MODEL Ph.D. Thesis
Wayne R. Knight 1972 159 p
Avail: Univ. Microfilms Order No. 72-25056

The two fluid cosmological models developed by Tolman in the period from 1929 to 1936 are extended to include the simplest form of interaction between matter and radiation occurring within the stellar systems which are associated with the transformation of hydrogen into iron. The model begins with the assumption that the universe is closed and that the distributions of the matter and radiation fluidic components within it are both isotropic and homogeneous; the time rate of radiation formation is proportional to the amount of available hydrogen in the universe. In seeking a solution to the field equations, the possibility of a stable, static model is examined, and it is shown that the interactions between the matter and radiation provide a global perturbation which results in the collapse or divergence of the static model depending on the character of the interactions. Dissert. Abstr.

N73-22653*# Rice Univ., Houston, Tex. Dept. of Physics.
AN EPR INVESTIGATION OF THE DYNAMIC JAHN-TELLER EFFECT IN SrCl2:Y(2 PLUS) AND SrCl2:Sc(2 PLUS)
J. R. Herrington, T. L. Estle, and L. A. Boatner (Advanced Technol. Center, Inc.) [1972] 41 p refs Sponsored in part by NSF (Grant NGR-44-006-001)
Avail: NTIS HC $4.25 CSCL 20H

EPR spectra have been observed for SrCl2:Y(2+) and SrCl2:Sc(2+) at liquid helium temperatures. At 1.2 K the spectra were dominated by anisotropic hyperfine patterns whose lineshapes and angular dependences were explained using second order solutions of the effective Hamiltonian for an isolated 2Eg state split by large random internal strains. Pronounced asymmetries in some of the strain produced lineshapes for Srcl2:Sc(2+) are shown to result from second order terms in the solution of the effective Hamiltonian. Coexisting with the anisotropic hyperfine patterns are weak nearly isotropic hyperfine patterns with typical lineshapes. Variations in the apparent intensity of lines in these weak hyperfine patterns as functions of the applied magnetic field direction and temperature imply that these lines result from averaging by vibronic relaxation of a portion of the anisotropic pattern. The effective Hamiltonian parameters for SrCl2:La(2+), SrCl2:y(2+), and SrCl2:SC(2+) are analyzed in terms of crystal field theory modified to include a dynamic Jahn-Teller effect. Author

N73-22654# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Solid State Sciences Lab.
HIGH FLUX ELECTRON IRRADIATIONS Physical Sciences Research Papers
L. O. Bouthillette and L. F. Lowe 26 Jun. 1972 11 p refs
(AF Proj. 5621)
(AD-749856; AFCRL-72-0398; AFCRL-PSRP-499; Rept-73-00808) Avail: NTIS HC $3.00 CSCL 18/4

Experimental techniques were developed for achieving high flux, high energy (1.5 MeV) electron irradiations in conjunction with radiation effect studies. Using these techniques a system was designed and fabricated which allowed irradiations to be carried out at a flux of 4 x 10 to the 14th power e(-)/sq cm/sec on a routine basis. These flux levels allowed fluences of 10 to the 19th power e(-)/sq cm to be achieved in a one-day irradiation. Author

N73-22655*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF THE SCATTERING OF H AND He ATOMS IN HYDROGEN
V. B. Leonas and A. V. Sermyagin Washington NASA 1973 14 p refs Transl. into ENGLISH from Russian report Pr-128 (Contract NASw-2483)
(NASA-TT-F-14900; Pr-128) Avail: NTIS HC $3.00 CSCL 20H

A quantitative comparision was made of measured and calculated effective differential and integral scattering cross sections for the H - H2 and He - H2 systems, which are simplest in the electron ratio. The measurements were made on the basis of theoretical anisotropic potentials. Author

N73-22656*# Scientific Translation Service, Santa Barbara, Calif.
MULTIPERIPHERISM AND THE HYDRODYNAMIC THEORY OF MULTIPLE PROCESSES
Yu. P. Nikitin and I. L. Rozental Washington NASA May 1973 19 p refs Transl. into ENGLISH of "Multiperiferizm i Gidrodinam. Teoriya Mnozhestvennykh Protsessov", Rept. Pr-121 Acad. Sci. USSR, Inst. for Space Res., Moscow, 1972 24 p (Contract NASw-2483)
(NASA-TT-F-14896; Pr-121) Avail: NTIS HC $3.00 CSCL 20H

The basic concepts and the results of multiperipherism are discussed. An analysis is made of the physical meanings of the basic postulates of multiperipherism, followed by an examination of the theory of multiple processes. Author

N73-22657# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
USE AND PROCESSING OF NUCLEAR EMULSIONS AS PARTICLE DETECTORS Instrumentation Papers
Katsura Fukui 12 Oct. 1972 130 p refs
(AF Proj. 8600)
(AD-756826; AFCRL-72-0613; AFCRL-IP-180) Avail: NTIS CSCL 18/4

The paper was written primarily for the technicians who handle nuclear emulsions. It covers some of the fundamental techniques for the daily use of nuclear emulsion in the laboratory. Although some newly developed methods are included, most effort was devoted to giving further detail on already established methods. Techniques for preparing the emulsion sample, exposing the emulsion to radiation, processing the emulsion, photomicrography, scanning and measuring are described in simple language. Author (GRA)

N73-22658# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A SHOCK TUBE STUDY OF DF VIBRATIONAL RELAXATION Final Report, Jan. - Sep. 1971
Jerry F. Bott and Norman Cohen 1 Feb. 1973 36 p refs
(Contract F04701-72-C-0073)
(AD-756462; TR-0073(3541)-2; SAMSO-TR-73-38) Avail: NTIS CSCL 07/4

The vibrational relaxation of DF behind incident shock waves in the temperature range 800 to 4000K was studied by monitoring the 3.5-micro m infrared emission. Relaxation times reduced to standard pressure were obtained for mixtures containing 1 to 10% DF in Ar and for mixtures containing N2, H2, and F atoms. These data were used for calculation of the relaxation times of DF due to these various gases. The deactivation rate of DF by F was measured. The measurements were compared to the predictions of several theories of vibration-to-translation and vibration-to-rotation energy transfer. GRA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-22659 Minnesota Univ., Minneapolis.
MILLIMETER WAVE HARMONIC GENERATION BY AN INDIUM ANTIMONIDE MAGNETOPLASMA Ph.D. Thesis
Ronald Lee Soderstrom 1972 101 p
Avail: Univ. Microfilms Order No. 72-27809

An investigation of third harmonic generation in an indium antimonide (InSb) magnetoplasma is reported. The semiconductor InSb normally provides very high loss to the propagation of millimeter microwaves; but in the presence of a dc magnetic field the InSb magnetoplasma provides nearly lossfree propagation. The experiment utilizes recently discovered loss-free magnetoplasma modes of microwave propagation called twist modes. Dissert. Abstr.

N73-22660 Lehigh Univ., Bethlehem, Pa.
THE RELATION BETWEEN MAGNETOHYDRODYNAMICS AND SPACE AND TIME DEPENDENT CORRELATION FUNCTIONS Ph.D. Thesis
Paul Bruce Corkum 1972 117 p
Avail: Univ. Microfilms Order No. 72-25870

Correlation functions of a plasma to linearized hydrodynamics have been extended to the case: (1) where the interaction between the components of the plsama is not restricted to the Coulomb interaction; and (2) where a constant, uniform, external magnetic field is present. The method used is a perturbation technique based on the assumption that the correlation function can be decomposed into a slow hydrodynamic and a rapid microscopic part. The transport coefficients are shown to depend on the microscopic part of the correlation functions between the fluxes and sources associated with the conserved quantities, and the static correlations. Dissert. Abstr.

N73-22661 Johns Hopkins Univ., Baltimore, Md.
TOPICS IN RELATIVISTIC MAGNETOHYDRODYNAMICS Ph.D. Thesis
George Lincoln Murphy 1972 186 p
Avail: Univ. Microfilms Order No. 72-25000

After a review of topics in general relativity, hydrodynamics and electrodynamics, a formulation of relativistic magnetohydrodynamics is presented. An action principle is used to discuss some of the requirements for a correct energy - momentum tensor. An attempt to put magnetohydrodynamics in already unified form is considered and it is shown that only the algebraic part of the problem can be solved. The weak field approximation for magnetohydrodynamics is developed by solving the Einstein and Maxwell equations in successive orders in the weak field parameter. Consequences of the fact that the magnetohydrodynamic energy - momentum tensor does not skip orders, as does that of hydrodynamics, are discussed and the extension of the results to finite conductivities is treated briefly. Dissert. Abstr.

N73-22662*# Scientific Translation Service, Santa Barbara, Calif.
APPLIED MAGNETOHYDRODYNAMICS, REPORT NO. 10, MHD-TEST FACILITY ARGAS 2: DESCRIPTION AND OPERATIONS
T. Bohn, K. Grawatsch, P. Komarek, H. Lang, and G. Noack Washington NASA May 1973 92 p refs Transl. into ENGLISH from Kernforschungsanlage Julich Ges. mit Beschrankter Haftung, (West Germany) report no. Jul-883-TP, Aug. 1972 p 87
(Contract NASw-2483)
(NASA-TT-F-14876; Jul-883-TP) Avail: NTIS HC $6.75 CSCL 20I

The enlargement of the Argas 2 facility to provide for the use of a superconducting magnet is described including the experimentation zone with nozzle, channel, diffuser, superconducting magnet, and the seed material circuit. Problems occurring during operation are discussed and the cesium circuit is analyzed. F.O.S.

N73-22663*# Stanford Univ., Calif. Inst. for Plasma Research.
APPROXIMATIONS TO THE PLASMA DISPERSION FUNCTION
A. L. Brinca Dec. 1972 30 p refs
(Grant NGL-05-020-176)
(NASA-CR-131496; SU-IPR-500) Avail: NTIS HC $3.50 CSCL 20I

Linear wave propagation in hot collisionless plasmas is described by the linearized Vlasov and Maxwell equations. In uniform media, the utilization of spatial and temporal transforms of those equations leads to the consideration of integrals of the Hilbert transform type. Analysis and comparison of two simple approximations are provided based on the utilization of resonance velocity distributions. Application is then made to the Landau and whistler waves, along with a discussion of the results, and commentary on possible improvements. Author

N73-22664*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
STATISTICAL MECHANICS OF NEGATIVE TEMPERATURE STATES
David Montgomery and Glenn Joyce Mar. 1973 38 p refs
(Grant NGL-16-001-043; Contract AT(11-1)-2059)
(NASA-CR-131572; U-of-Iowa-73-7) Avail: NTIS HC $4.00 CSCL 20I

The dynamics of two-dimensional interacting line vortices is identical to that of the two-dimensional electrostatic guiding center plasma. Both are Hamiltonian systems and are therefore

susceptible to statistical mechanical treatments. The predictions of the microcanonical ensemble are explored for this system. Interest focuses primarily on the regime of total positive interaction energy, which should be above the Onsager negative temperature threshold. Calculations of the probability distribution for a component by means of the central limit theorem are carried out in the manner of Khinchin. The probability distribution of a component is reduced to the usual Gibbs distribution in the regime of positive temperatures, and is still explicitly calculable for negative temperatures. The negative temperature states are neither quiescent nor spatially uniform. Expressions for the temperature are explicitly provided in terms of the total particle energy and particle number. A BBGKY hierarchy can be derived for both temperature regimes. Numerical simulations involving solutions of the equations of motion of 4008 particles are presented.
Author

N73-22665*# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ALFVEN WAVES IN SPIRAL INTERPLANETARY FIELD
Y. C. Whang Mar. 1973 21 p refs
(Grant NGR-09-005-063)
(NASA-CR-131569) Avail: NTIS HC $3.25 CSCL 20I

A theoretical study is presented of the Alfven waves in the spiral interplanetary magnetic field. The Alfven waves under consideration are arbitrary, large amplitude, non-monochromatic, microscale waves of any polarization. They superpose on a mesoscale background flow of thermally anisotropic plasma. Using WKB approximation, an analytical solution for the amplitude vectors is obtained as a function of the background flow properties: density, velocity, Alfven speed, thermal anisotropy, and the spiral angle. The necessary condition for the validity of the WKB solution is discussed. The intensity of fluctuations is calculated as a function of heliocentric distance. Relative intensity of fluctuations as compared with the magnitude of the background field has its maximum in the region near I au. Thus outside of this region, the solar wind is less turbulent.
Author

N73-22666# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LABORATORY SIMULATION OF IONOSPHERIC PLASMA
Marc Charpenel and Daniel Pigache 1972 22 p refs In FRENCH; ENGLISH summary
(ONERA-NT-202) Avail: NTIS HC $3.25

An exact simulation of satellite motion in the ionospheric plasma has been obtained in a large vacuum chamber by means of a synthesized collisionless plasma stream produced by a low energy and high current density ion source. The plasma density, the beam velocity, and the electron temperature can be varied between 10 thousand and 1 million/cm3, 7 and 30 km/sec, 500 and 2000 K respectively. An approximate simulation of a sounding rocket motion in the D and E layers has been obtained with the same plasma source by increasing the pressure in the vacuum chamber. The ion beam velocity is then reduced to zero but the variation ranges of plasma density and electron temperature are unchanged.
Author

N73-22667# Sandia Labs., Albuquerque, N.Mex. Aerodynamic Research Dept.
CONTINUUM ELECTROSTATIC PROBES IN THE PRESENCE OF NEGATIVE IONS: NUMERICAL COMPUTATION
Paul B. Baily and Kenell J. Touryan 8 Feb. 1973 26 p refs Sponsored by AEC Back-up document for AIAA Synoptic, "Continuum Electrostatic Probes in the Presence of Negative Ions: A Numerical Solution", scheduled for publication in AIAA Journal in September 1973
(Log-J7146) Avail: NTIS HC $3.50

Numerically calculated current-voltage characteristics are given for a weakly ionized plasma that contains negative ions with unequal electron and ion temperature (electron T > ion T). Charged particle concentration curves are obtained that exhibit the detailed structure of the sheath as well as the ambipolar region in the presence of negative ions. It is shown that the sheath plays a much greater role in determining the ion saturation current when electron T > ion T (thermally frozen flow conditions) than when the flow is in thermal equilibrium. It was found that negative ions suppress both the electron saturation current and the positive ion saturation current, in agreement with earlier results.
Author

N73-22668# Institut Franco-Allemand de Recherches, St. Louis (France).
INFRARED DIAGNOSTICS BY MEANS OF LIQUID CRYSTAL DETECTORS [INFRAROTDIAGNOSTIK MIT HILFE VON FLUESSIGKRISTALLDETEKTOREN]
M. Hugenschmidt and K. Vollrath 7 Aug. 1972 21 p refs In GERMAN
(Contract T/0260/22630/21015)
(ISL-18/72) Avail: NTIS HC $3.25

The design and properties of several liquid crystal infrared detectors are described in their application to the visualization of electric spark discharges using pulsed carbon dioxide TEA lasers. Several measurements and calculations show that liquid crystal layers are suitable for the detection of rapidly varying phase objects using carbon dioxide laser pulses. The spatial resolution of the investigated arrangement is limited by the finite rise time and lies at a maximum of 10 lines/mm. For holographic applications, a resolution of between 150 and 200 lines/mm is necessary. Liquid crystal detectors allow excellent optical recording using conventional methods, such as: Schlieren and shadowgraphy as well as with interferometry.
ESRO

N73-22669# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
EFFECT OF THE MOTION OF A PLASMA PARALLEL TO THE MAGNETIC FIELD ON THE DETERMINATION OF OBLIQUE RESONANCE BY MEANS OF A QUADRUPOLE PROBE [EFFET D'UN MOUVEMENT DU PLASMA PARALLELEMENT AU CHAMP MAGNETIQUE SUR LA DETERMINATION DES RESONANCES OBLIQUES A L'AIDE D'UNE SONDE QUADRIPOLAIRE]
R. Pottelette 1972 79 p refs In FRENCH Sponsored by CNES
(GRI/NTP/110) Avail: NTIS HC $6.00

Transverse plasma resonances were determined using a linear quadrupolar probe. Near these resonances, the transfer impedance of such a probe is affected by the relative motion of ambient plasma. Using the results obtained from measurements, it was possible to measure, in the magnetosphere, the flux velocity of thermal electrons parallel to the magnetic field, and the electron current.
ESRO

N73-22670*# Stanford Univ., Calif. Inst. for Plasma Research.
SYNCHROTRON SOURCES, 1: EXTENSION OF THEORY FOR SMALL PITCH ANGLES
Richard I. Epstein Nov. 1972 40 p refs
(Grant NGL-05-020-272; Contract N00014-67-A-0112-0062; Grant NSF GP-23840; NR Proj. 323-009)
(NASA-CR-131864; AD-756664; SU-IPR-495) Avail: NTIS HC $14.00 CSCL 20/9

The author examines some of the features of synchrotron radiation which occur when relativistic particles move with small pitch angles in a magnetic field. The emission from individual particles is computed; the general properties of the emission from distributions of particles with small pitch angles are discussed; and, finally, the emissivities and degrees of polarization for several specific source models are presented. Author (GRA)

N73-22671# Maryland Univ., College Park. Dept. of Physics and Astronomy.
PRODUCTION OF THERMONUCLEAR PLASMAS BY ANOMALOUS DIFFUSION OF MAGNETIC FIELDS IN A HIGH VOLTAGE THETA PINCH Annual Summary Report
Nov. 1972 54 p refs
(Contract N00014-67-A-0239-0015; NR Proj. 099-395)
(AD-757043) Avail: NTIS CSCL 20/9

The report summarizes work done at the University of Maryland on the problem of plasma heating by application of a large amplitude magnetic pulse to the plasma boundary. Particular interest is given to understanding the ion heating that results from growth of drift instabilities. In the period covered by the report the experimental work has concentrated on parametric studies of ion heating for various initial conditions, and on measurements of density fluctuations by light scattering. The theory work has been concentrated in finding realistic models

for resistive and viscous loss to be used in numerical fluid codes. Author (GRA)

N73-22672# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
PLASMA ENHANCEMENT AND DIAGNOSTIC POSSIBILITIES OF SELECTIVE LASER EXCITATION Final Scientific Report, 1968 - 1973
Raymond M. Measures Jan. 1973 7 p refs
(Grant AF-AFOSR-1608-68; AF Proj. 9752)
(AD-755373; AFOSR-73-0110TR) Avail: NTIS CSCL 20/9

The progress made towards demonstrating the viability of the new plasma diagnostic technique referred to as Selective Excitation Spectroscopy has been outlined and other related topics mentioned. The results to date are encouraging and developments in the field of tunable lasers should enable this new approach to be used in a variety of applications. Author (GRA)

N73-22673# Air Vehicle Corp., San Diego, Calif.
CALCULATION OF NON-STEADY FLOW IN THE LINEAR MHD GENERATOR Final Report
Jan J. Rosciszewski and T. T. Yeh Dec. 1972 57 p refs
Sponsored in part by AFOSR
(Contract N00014-72-C-0019; NR Proj. 099-397)
(AD-755203) Avail: NTIS CSCL 10/2

The report consists of the following two parts: Shock tube flow passing through a section of a linear MHD generator; and Establishment of quasi-steady conditions in a blow-down non-equilibrium MHD generator. GRA

N73-22674# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
A STUDY OF ELECTRON DENSITY DISTRIBUTION IN VISCOUS FLOWS
Henry G. Lew Nov. 1972 53 p refs
(Contract F19628-72-C-0070; AF Proj. 4642)
(AD-755397; DOC-72SD2189; AFCRL-72-0718; SR-1) Avail: NTIS CSCL 16/3

The electron production for the viscous flow over a body in hypersonic flight and high altitudes has been studied and predictions of its magnitude have been made. The flight parameters selected for this study were typical of those encountered by the reentry nosecone experiments launched in a series of Air Force Cambridge Research Laboratories/Trailblazer 2 Rocket Flights. A chemical system appropriate for high temperature dissociated and ionized air has been utilized. In addition to NO- the chemical kinetic system includes N2-, O2-, O-, N-. Both chemical and nonequilibrium effects are included. An evaluation of various wall conditions such as catalyticity and slip, of diffusion coefficients, and of magnitudes of various rate constants has also been considered. Author (GRA)

N73-22675# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.
SYNCHROTRON-CHERENKOV RADIATION OF RELATIVISTIC ELECTRONS IN A COLD PLASMA
Gabor Kalman and Stanford Yukon Apr. 1972 108 p refs
(Contract F19628-71-C-0078; AF Proj. 8608)
(AD-755387; AFCRL-72-0290; SR-3) Avail: NTIS CSCL 20/9

The radiation emitted by a relativistic electron in a cold magnetoplasma is calculated employing the method of energy loss. While the power loss per unit frequency interval in the neighborhood of the ionic, electronic, or plasma reasonance is divergent, it is shown to be integrable for each harmonic of the relativistic gyrofrequency. The sum of the power losses over all harmonics, though, is divergent as the logarithm of the maximum harmonic number, for a wide frequency domain depending on the pitch angle alpha and direction of propagation theta. By decomposing the total radiation into longitudinal and transverse parts the transverse portion is shown to be finite everywhere. A computer code has been developed to calculate the total and transverse power spectra for arbitrary plasma and particle parameters. Results for a variety of particle energies and pitch angles are presented. Author (GRA)

N73-22676# Ohio State Univ. Research Foundation, Columbus.
GYRO-SYNCHROTRON RADIATION FORMULAE Final Report, 1 Oct. 1969 - 30 Sep. 1972
H. C. Ko Nov. 1972 19 p refs
(Contract F19628-70-C-0019; AF Proj. 4643)
(AD-755398; AFCRL-72-0722) Avail: NTIS CSCL 20/9

The wave-normal emissivity and the ray emissivity formulae for an electron moving along a helical path in a magnetoactive medium are presented. Simplified formulae for the case of an isotropic plasma are also given. Because of the helical motion of the electron, one must distinguish between the radiated power per unit solid angle and the received power per unit solid angle. The relation between these two quantities in a magnetoactive medium is shown. The results are compared with those obtained by others, and the sources of discrepancies are pointed out. Author (GRA)

N73-22677# Missouri Univ., Rolla. Dept. of Physics.
CROSS SECTION FOR PHOTOIONIZATION OF EXCITED CESIUM ATOMS Final Technical Report, 1 Mar. 1969 - 31 Oct. 1972
Kaare J. Nygaard 31 Dec. 1972 96 p refs
(Contract N00014-69-C-0271; NR Proj. 099-390)
(AD-756217; TR-4) Avail: NTIS CSCL 20/9

The cross section for photoionization of excited cesium atoms has been measured in a triple crossed-beam experiment, i.e., two light beams crossing a beam of cesium atoms. The beam of exciting radiation was produced by a GaAs laser or by a cesium hollow cathode discharge lamp. The beam of ionizing radiation was produced by a 250 watt mercury arc lamp and dispersed by a 1/3 meter monochromator. The results show that the cross section as a function of photon energy decreases faster than in the recombination measurements of Mohler and Boeckner. The report also includes separate articles on GaAs lasers, cesium masers, laser plasmas, and electron impact ionization, all related to the major photoionization program. Author (GRA)

N73-22678# ILC Technology, Inc., Sunnyvale, Calif.
DEVELOPMENT OF A COMPACT SEALED BEAM PLASMA ARC ILLUMINATOR WITH AN INTEGRAL REFLECTOR Final Technical Report
John Richter Jan. 1973 31 p refs
(Contract DAAK02-71-C-0199)
(AD-756968; R-ILC-72-37) Avail: NTIS CSCL 20/6

The objective was the development of new narrow beam plasma arc illuminators that would be more efficient than present xenon arc illuminators. Higher efficiency was desired in the visible (0.4 to 0.7 micrometers) and near infrared (0.82 to 1.0 micrometers). The development effort accomplished the fabrication of the first sealed beam illuminator using an alkali metal vapor source with a clear sapphire envelope. Furthermore the alkali metal lamps, although presently disappointing in efficiency in the desired bands, appear to have high potential for at least two other applications. First, the infrared spectrum beyond 1 mircometer can be made similar to that of a black body, making the lamp potentially useful as a CW or pulsed point source for countermeasures. Second, the spectrum has peaks in the near infrared that should be useful for pumping Nd:YAG lasers. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-22679 Pennsylvania Univ., Philadelphia.
VARIATIONS IN ELECTRICAL PROPERTIES OF SILICON FILMS ON SAPPHIRE USING THE MOS HALL TECHNIQUES Ph.D. Thesis
Alfred Charles Ipri 1972 94 p
Avail: Univ. Microfilms Order No. 72-25593

An experimental technique is described for determining the electrical properties of thin semiconducting films as a function of distance from the surface. The method is applied to silicon on sapphire films nominally one micron thick and doped n and p type on the order of 2-6 x 10 to the 16 power/cu cm, and the variation in average mobility and carrier concentration with depth into the layer is determined. A physical model for the

variation of these parameters in the films is proposed which fits the experimental data and it consists of a linearly decreasing mobility and constant impurity profile. The existence of a significantly wide non-conducting sub-layer within the film is also suggested. It is found that the postulated model is successful in accurately predicting the actual surface concentration. Variable temperature measurements were performed in order to determine the nature of the dielectric layer as well as the cause of the mobility gradient. The MOS Hall technique was used to measure the temperature dependence of the average electron and hole mobilities at various depths into the film. Dissert. Abstr.

N73-22680 Minnesota Univ., Minneapolis.
HOT ELECTRON EFFECTS IN SCL DIODES AND MOSFET'S Ph.D. Thesis
Mona Mahmound Abdel-Rahman 1972 209 p
Avail: Univ. Microfilms Order No. 72-27156

It is reported that a sufficiently strong electric field applied to a semiconductor will drive its carriers (electrons or holes) into a state in which their average energy is appreciably higher than the thermal equilibrium value proper to the crystal substrate temperature. This process is referred to as hot electron effect. It is further reported that with such a high field Ohms Law is no longer applicable, and the assumption of a constant mobility is no longer valid. Finally, the mobility at high field of SCL diodes and MOSFET can be represented by Shockley's equation. Dissert. Abstr.

N73-22681 Rice Univ., Houston, Tex.
THE INFLUENCE OF DISSOLVED HYDROGEN ON THE SUPERCONDUCTING PROPERTIES OF MOLYBDENUM Ph.D. Thesis
Brahm Dev Bhardwaj 1972 101 p
Avail: Univ. Microfilms Order No. 72-26392

The superconducting and mechanical properties of triple electron-beam float-zone refined single crystals of molybdenum were studied before and after the addition of dissolved hydrogen. A dynamic method was used for the measurement of the electrodynamic properties. Pippard's electrodynamic theory of field penetration was extended to account for the observed dynamics of the phase transition from the superconducting to the normal state. Hydrogen was diffused at 1553 K and 1823 K. The normal state resistivity below the critical temperature is found to increase on the addition of hydrogen, indicating that the electron mean free path decreases due to impurity scattering. The transition temperature, however, is insensitive to the dissolved hydrogen within the error of the temperature measurements. Dissert. Abstr.

N73-22682 Rutgers Univ., New Brunswick, N.J.
THERMAL CONDUCTIVITY OF THE KONDO SUPERCONDUCTOR Zn-Mn Ph.D. Thesis
Daniel Horacio Sanchez 1972 102 p
Avail: Univ. Microfilms Order No. 72-27591

The thermal conductivity in bulk samples of pure Zn and the Kondo alloys Zn-Mn were measured in the temperature range 360 K to about 1.0 K for the concentrations 2.7, 6.0, 8.4, 10.0 and 11.7 parts per million (PPM) Mn. Results for the depression of the superconducting to normal state transition temperature with Mn concentrations and for the temperature dependence of the thermal conductivities of pure Zn agree with the results obtained by other workers. The ratios of the thermal conductances in the superconducting to normal states were quantitatively compared with the Bardeen, Rickayzen and Tewordt, and Ambegaokar and Griffin theories. Agreement was found between the Ambegaokar and Griffin theory and experiment at all temperatures for Mn concentrations lower than 10.0 PPM and discrepancy between theory and experiment in the 10.0 PPM and 11.7 PPM samples. In the latter specimens the measured conductance ratios were greater than the theoretical predictions. Dissert. Abstr.

N73-22683 Pennsylvania Univ., Philadelphia.
A STUDY OF POROUS STRUCTURE AND SURFACE ENERGETICS OF EVAPORATED METAL THIN FILMS Ph.D. Thesis
Hee Mok Chung 1972 419 p
Avail: Univ. Microfilms Order No. 72-25551

A new method of characterizing the detailed surface energy distribution of solids is sought. Also, an investigation is made of the nature and mechanisms of porous structure and its formation in vacuum evaporated metal thin films in correlation with their deposition parameters and gas adsorption behaviors. Gas adsorption analysis and electron microscopy were utilized as experimental techniques with the aid of mass spectrometry. Sets of physically adsorbed Xe and Kr isotherms on vacuum evaporated Ni and Pd thin films were measured at temperatures between 77.4 K and 90.2 K by continuous flow manometric method. The surface topography and energy heterogeneity were induced to gradually change by preadsorbing various amounts of oxygen at room temperture. Isosteric heats of adsorption of Xe on Pd were determined as a function of prechemisorbed oxygen coverage on clean surface. Dissert. Abstr.

N73-22684# Ruhr Univ., Bochum (West Germany). Abteilung fuer Elektrotechnik.
ELECTRON SPIN RESONANCE WITH QUARTZ STABILIZED MEASUREMENTS AND RESONATOR WITH AUTOMATIC TUNING [ELEKTRONENSPIN-RESONANZ MIT QUARZ-STABILER MESSFREQUENZ UND RESONATOR MIT ABSTIMMAUTOMATIK]
Hans Martin Fromherz 1971 103 p refs In GERMAN
Avail: NTIS HC $7.25

Design and development of an electron spin resonance spectrometer with quartz stabilized microwave measurement frequency and a mechanically and electronically tunable measurement resonator, is reported. Transl. by G.G.

N73-22685# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
CARRIER LIFETIME MEASUREMENT BY THE PHOTOCONDUCTIVE DECAY METHOD
Richard L. Mattis and A. James Baroody, Jr. Sep. 1972 49 p refs Sponsored in part by DNA
(NBS-TN-736) Avail: SOD $0.50 as C13.46:736

The photoconductive decay (PCD) method of carrier lifetime measurement is discussed with emphasis on experimental and analytical work done at NBS. The relationship between photoconductive decay time, bulk decay time, and lifetime is described briefly and the PCD method is summarized. Experimental data, supported by theoretical considerations, are presented to demonstrate the dependence of PCD time on excess carrier density, the type of light source, specimen homogeneity, filter thickness, and temperature. The dependences of PCD time on excess carrier density and temperature are consequences of the statistics of the recombination process. Measurements made with chopped light excitation are shown to be less in error due to higher modes of recombination than are measurements made with pulsed light excitation. The presence of inhomogeneities is verified in two crystals. Use of a filter is also shown to reduce the influence of higher modes. An unexpected reduction in PCD time with increasing filter thickness is shown to be caused by an inhomogeneity. Author

N73-22686*# Tyco Labs., Inc., Waltham, Mass.
THICK SILICON GROWTH TECHNIQUES Quarterly Progress Report, 1 Dec. 1972 - 28 Feb. 1973
H. E. Bates, A. I. Mlavsky, and D. N. Jewett 28 Feb. 1973 29 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953365)
(NASA-CR-131601; QPR-4) Avail: NTIS HC $3.50 CSCL 20B

Hall mobility measurements on a number of single crystal silicon ribbons grown from graphite dies have shown some ribbons to have mobilities consistent with their resistivities. The behavior of other ribbons appears to be explained by the introduction of impurities of the opposite sign. Growth of a small single crystal silicon ribbon has been achieved from a beryllia dia. Residual internal stresses of the order of 7 to 18,000 psi have been determined to exist in some silicon ribbon, particularly those grown at rates in excess of 1 in./min. Growth experiments have continued toward definition of a configuration and parameters to provide a reasonable yield of single crystal ribbons. High vacuum outgassing of graphite dies and evacuation and backfilling of growth chambers have provided significant improvements in surface quality of ribbons grown from graphite dies. Author

N73-22687*# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
STRUCTURAL EXPANSIONS FOR THE GROUND STATE ENERGY OF A SIMPLE METAL
J. Hammerberg and N. W. Ashcroft Jan. 1973 70 p refs
(Grants NGR-33-010-188; NSF GH-33637)
(NASA-CR-131833; Rept-1943) Avail: NTIS HC $5.50 CSCL 06F

A structural expansion for the static ground state energy of a simple metal is derived. An approach based on single particle band structure which treats the electron gas as a non-linear dielectric is presented, along with a more general many particle analysis using finite temperature perturbation theory. The two methods are compared, and it is shown in detail how band-structure effects, Fermi surface distortions, and chemical potential shifts affect the total energy. These are of special interest in corrections to the total energy beyond third order in the electron ion interaction, and hence to systems where differences in energies for various crystal structures aie exceptionally small. Preliminary calculations using these methods for the zero temperature thermodynamic functions of atomic hydrogen are reported.
Author

N73-22688# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
PREPARATION OF SUBSTRATES FOR USE IN EPITAXY Final Report [PREPARATION DES SUBSTRATS EN VUE DE LEUR UTILISATION EN EPITAXIE]
A. Huber 14 Apr. 1971 8 p refs In FRENCH
(Contract DGRST-69-018-18)
Avail: NTIS HC $5.50

A method for the characterization of GaAs substrates was established. Crystal defects were identified using optical and electron microscopy, as well as X-ray radiography. Methods for the preparation and polishing of GaAs substrate surface were developed. The correlation of the interface properties to the epitaxial layer quality was demonstrated and led to the optimization of some preparation parameters of the epitaxial layer. ESRO

N73-22689# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
DEVICE FABRICATION AND RADIATION EFFECTS STUDIES OF VARIOUS SEMICONDUCTORS
T. W. Kim and W. W. Grannemann Dec. 1972 135 p refs
(Contract N00014-68-A-0158)
(AD-756249; EE-200(72)ONR-005) Avail: NTIS CSCL 09/1

Results of studies are presented on electron beam evaporated high-mobility indium antimonide and III- V compound semiconductor thin films; Radiation effects on hall and magnetoresistance devices of In Sb bulk and thin films; Silicon and Ga As P metal-insulator-semiconductor capacitors; and Te thin-film transistors.
Author

N73-22690# International Business Machines Corp., Hopewell Junction, N.Y. East Fishkill Lab.
DAMAGE PROFILES IN SILICON AND THEIR IMPACT ON DEVICE RELIABILITY Technical Report, 6 Jun. - 30 Dec. 1972
Guenter H. Schwuttke 1 Jan. 1973 32 p refs
(Contract DAHC15-72-C-0274; ARPA Order 2196)
(AD-756250; TR-1) Avail: NTIS CSCL 20/12

Standard silicon wafers are shown to frequently contain residual mechanical saw damage in the surface. The damage is identified through transmission electron microscopy (TEM) as microsplits of the silicon lattice. Microsplits are not detectable by standard inspection, screening or etching techniques. Microsplit dimensions range from 0.1 to 10 micrometer. The density of the splits can vary from zero to 10 to the 6th power/sq cm or even higher. Microsplits are shown to cause loss of storage time in MOS capacitors.
Author (GRA)

N73-22691# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
FAR INFRARED LASER SPECTROSCOPY OF SPIN-CLUSTERS IN THE LINEARISING SYSTEM CoCl2 2H2O
David Frank Nicoli Jan. 1973 248 p refs
(Contract N00014-67-A-0298-0022; DAHC15-67-C-0219; Grants NSF GH-33576; NSF GH-34133X; NR Proj. 018-407)
(AD-756264; TR-5) Avail: NTIS CSCL 20/12

A far infrared HCN/DCN laser source and high field superconducting solenoid were used to perform high resolution swept-field spectroscopy of the linear chain magnetic system Co2.2H2O (CC2). The field dependent transmission of CC2 was measured at 29.7, 32.2, 51.4 and 52.7/cm over the temperature range 1.3 to 15K in applied fields of from zero to over 100 KOe. The relatively high output power and extreme monochromaticity of the laser source allowed for a qualitative improvement in the resolution of the spin-cluster resonance spectrum and the accurate determination of linewidths and intensities over a substantial temperature range. Spin-cluster excitations corresponding to the creation of multimagnons of effective size up to 14 adjacent flipped spins, with corresponding g-values as large as 95, have been clearly observed. Nearly complete even/odd-cluster manifold separation according to radiation polarization type was obtained. Data taken with the deuterated form of CC2 indirectly verified the existence of an optic phonon at about 29/cm, using its strong coupling to the ordinary spin-wave excitation. A set of new, weak resonances was observed in the middle field region of the spectrum using the HCN laser lines.
GRA

N73-22692# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A FEW PHYSICAL AND TECHNICAL ASPECTS OF THE ELECTRON TUNNELING PROCESS BETWEEN SUPERCONDUCTORS
D. H. Karras 31 Jan. 1972 40 p refs Transl. into ENGLISH from Feingeraetetechnik (East Germany), v. 19, no. 10, 1970 p 436-447
(AF Proj. 3145)
(AD-756081; FTD-HT-23-540-72) Avail: NTIS CSCL 20/12

The possible application to scientific instrumentation of the tunneling process in superconductors is discussed. After a brief description of the basic theory underlying superconductivity, experiments are described which confirm the tunneling process by unpaired electrons and by Cooper pairs. The tunnel current interferometer is described.
Author (GRA)

N73-22693# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMAL EMF: THERMAL AND ELECTRICAL CONDUCTIVITY
N. P. Vereshchaka, A. E. Bryukhanov, and V. F. Nemchenko 2 Jan. 1973 8 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (USSR), v. 31, no. 4, 1971 p 882-884
(AD-756595; FSTC-HT-23-2022-72) Avail: NTIS CSCL 20/12

There is little data in the literature on the physical properties of alloys based on rare earth metals (REM) and even pure REM. In this connection, the authors investigated the thermoemf, heat and electrical conductivity of alloys of the Nd-Y system at room temperature, in relation to component content and in the 0-650C temperature range for all alloys.
GRA

N73-22694# Army Foreign Science and Technology Center, Charlottesville, Va.
VARIATION OF ELECTRIC CONDUCTIVITY AND THERMAL E. M. F. AT FUSION OF COPPER CHALCOGENIDES
V. M. Glazon 29 Dec. 1972 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb Zaved., Isvet. Met. (Dzaudzhikau), v. 13, 1970 p 27-31
(AD-756088L; FSTC-HT-23-1273-72) Avail: NTIS CSCL 20/12

Experimental results are given for the electrical conductance and thermal emf of copper sulfide, copper selenide, and copper telluride.
GRA

N73-22695# General Electric Co., Schenectady, N.Y.
RAMAN SCATTERING STUDIES Final Technical Report, 15 Apr. - 31 Dec. 1972
Richard L. St.Peters, Seth D. Silverstein, William W. Morey, David J. Taylor, and Donald R. White 28 Feb. 1973 106 p refs
(Contract N00014-72-C-0503)
(AD-756808; SRD-73-033) Avail: NTIS CSCL 07/4

Absolute cross sections for rotational Raman scattering have been derived for N2 and O2 from the near UV to the IR, with

particular attention to 10.6 microns, using a theoretical extrapolation of data obtained in the visible. The feasibility of remote optical sensing using near resonant enhancement of Raman scattering has been studied by a search for such enhancement from ClF, Cs2, and Na2. Enhancement was seen from Na2, but the signal could not be clearly demonstrated as Raman scattering. Use of resonant effects (Raman, fluorescence, or absorption) in remote probing requires both a narrow line and high power from a tunable laser. Injection-narrowing of a high power flashlamp-pumped oscillator is shown to be an effective means to obtain a narrow line at reasonable power. Application of the Zig-Zag Face-Pumped laser configuration to dye lasers is shown to provide a high brightness, high average power amplifier, and a design basis for further development has been established.
Author (GRA)

N73-22696# Naval Postgraduate School, Monterey, Calif.
THE EFFECTS OF PROTON BOMBARDMENT ON PbSnTe M.S. Thesis
David Graham Anderson Dec. 1972 85 p refs
(AD-756542) Avail: NTIS CSCL 20/12

The effects of 200-250 KeV proton bombardment on both p-type and n-type Pb(0.80)Sn(0.20)Te thin films were investigated. Emphasis was placed on p-type samples to determine the feasibility and dosage required to change the carrier type and to determine the stability after bombardment. This method of conversion has promise in the fabrication of photovoltaic diode arrays for infrared applications. The samples were characterized by Hall effect and conductivity measurements from 90K to 300K.
Author (GRA)

N73-22697# Aerospace Corp., El Segundo, Calif. Lab. Operations.
HABIT OF Fe2O3 GROWN FROM Na2B4O7
Armand B. Chase and Frank L. Morse, Jr. 30 Jan. 1973 19 p refs
(Contract F04701-72-C-0073)
(AD-755349; TR-0073(9230-10)-4; SAMSO-TR-72-308) Avail: NTIS CSCL 20/2

Single crystals of hematite (Fe2O3) grown from Na2B4O7 occur as plates, rods, hoppers, and equidimensional solid crystals. The habit was found to correlate with the growth rate and crystal defects. Plates and rods occurred for the highest growth rates used with the plate size controlled by rapid growth perpendicular to the <0001>. The rods are the result of twinning on the (0,1,01,2). The hoppers and solid crystals grow in slow-cooled melts and are typical of crystals grown from high-viscosity melts.
Author (GRA)

N73-22698# Cornell Univ., Ithaca, N.Y. Materials Science Center.
THE SHORT RANGE STRUCTURE OF Ti AND Zr bcc SOLID SOLUTIONS CONTAINING THE OMEGA PHASE. 2: SOLUTION OF THE STRUCTURE DETERMINATION
Bernard Borie, Stephen L. Sass, and Alf Andreassen 18 Jan. 1973 33 p refs Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contract N00014-67-A-0077-0012; NR Proj. 031-734)
(AD-755454; MSC-1940; TR-9) Avail: NTIS CSCL 11/6

New techniques for computing intensity distributions from atomic arrangements with defects in periodicity were applied to a variety of models in an attempt to reproduce in detail the diffuse neutron diffraction pattern of a Zr-20 wt. % Nb alloy quenched from 1273K. The model which succeeds is described, and its kinematic intensity sum is derived. The resultant computed diffuse intensity distribution is compared with experiment.
Author (GRA)

N73-22699# Cornell Univ., Ithaca, N.Y. Materials Science Center.
THE SHORT RANGE STRUCTURE OF Ti AND Zr bcc SOLID SOLUTIONS CONTAINING THE OMEGA PHASE. 1: GENERAL DIFFRACTION THEORY AND DEVELOPMENT OF COMPUTATIONAL TECHNIQUES
Bernard Borie, Stephen L. Sass, and Alf Andreassen 18 Jan. 1973 33 p refs Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contract N00014-67-A-0077-0012; NR Proj. 031-734)
(AD-755463; MSC-1939; TR-8) Avail: NTIS CSCL 11/6

Certain Ti and Zr solid solutions containing the omega phase exhibit intensity distributions in reciprocal space which are partly diffuse. In an effort to understand the structural meaning of these diffraction patterns, the authors have developed new methods for the evaluation of the kinematic intensity sum for certain kinds of atomic arrangements which are not quite periodic. The methods are illustrated by their application to a simple model for these alloy systems. The model successfully reproduces some but not all of the features of observed intensity distributions.
Author (GRA)

N73-22700# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MEASUREMENT OF THE PYROELECTRIC COEFFICIENT OF 65/35 PZT Final Report
Vincent G. McGevna, John C. Saccenti, and John H. McNeilly Sep. 1972 44 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-755520; BRL-1614) Avail: NTIS CSCL 20/12

The pyroelectric coefficient of Lead Zirconate Titanate (Pb(Zr(0.65)Ti(0.35))O3 - 1 wt% Nb2O5) has been measured at temperatures from 10C to 100C. Values obtained from samples poled at ambient temperatures and repeatedly heated range from 0.022 microcoulombs/sq cm./degree C at 10C to 0.40 microcoulombs/sq cm./degree C at 100C. Samples electrically poled at ambient temperature require temperature annealing before reproducible pyroelectric values may be obtained. Samples electrically poled at higher temperatures provide larger pyroelectric values which are also reproducible. Exposure to gamma radiation did not produce noticeable differences in the pyroelectric coefficient for up to 1 million R total dose of 60 Cobalt.
Author (GRA)

N73-22701# North Carolina Univ., Chapel Hill.
ELECTRONIC STATES IN DISORDERED MATERIALS Semiannual Technical Report, 1 Feb. - 31 Jul. 1972
M. Silver and K. S. Dy 31 Jul. 1972 60 p refs
(Grant DA-ARO(D)-31-124-71-G52; ARPA Order 1562)
(AD-755260; AROD-9537-4-P) Avail: NTIS CSCL 20/12

Contents: Electronic structure of disordered systems; One-Dimensional arrays, bound bands; Models for steady state electron injection current into dense media; Mobility of electrons in dense helium gas.
GRA

N73-22702# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERCONDUCTORS IN MARINE TECHNOLOGY
Vladimir B. Zenkevich, Efim Ya. Kazovskii, Mark G. Kremlev, Pervomai V. Orlov, Vyacheslav V. Sychev, Mikhail I. Fedosov, and Valentin N. Shakhtarin 6 Dec. 1972 399 p refs Transl. into ENGLISH of the book "Sverkyprovodniki v Sudonoi Tekh." 1971 p 1-256
(AF Proj. 3145)
(AD-755711; FTD-HC-23-738-72) Avail: NTIS CSCL 20/3

Contents: The nature of superconductors; Materials for superconductive coils; Superconductive solenoids; Superconductive magnetic systems for magnetohydrodynamic transformers; Superconductive magnetic systems for transformers and generators; The use of superconductors in instruments and systems of navigation and steering; Current leads and feed systems for superconductive devices; Cryogenic technology.
GRA

N73-22703# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
USAF APPLICATIONS OF LIQUID CRYSTAL MATERIALS Technical Report, Nov. 1971 - Apr. 1972
Rudolph A. Champa May 1972 28 p refs
(AF Proj. 7360)
(AD-755831; AFML-TR-72-77) Avail: NTIS CSCL 20/6

The current state-of-the-art in liquid crystals (LC) as electronic, electro-optic and diagnostic materials is examined with emphasis on unique properties and applications to USAF systems. Research in basic physical organic chemistry is suggested to fill gaps in the current knowledge of LCs which have limited their use in the above applications. A point-of-contact list of both DOD and non-government personnel involved in LC research is given together with a short description of the individual work effort.
Author (GRA)

N73-22704# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
LOW TEMPERATURE GROWTH OF CUBIC GALLIUM NITRIDE Annual Report
Michael A. Littlejohn, John R. Hauser, and James E. Andrews Jan. 1973 9 p
(Contract N00014-70-A-0120-0004; NR Proj. 243-006)
(AD-755237) Avail: NTIS CSCL 20/2

A system is described which uses the organometallic compound triethygallium monammine (Ga(C2H5)3.NH3) for the chemical vapor deposition of thin films of gallium nitride. Measurements and studies of the physical characteristics and the electrical properties of films obtained from this process are described. The emphasis of this work is towards achieving low temperature (-600C) growth of gallium nitride in the cubic crystal structure. Author (GRA)

N73-22705# Monsanto Research Corp., St. Louis, Mo.
MAGNETIC BUBBLE MATERIALS Semiannual Technical Report, 12 Jul. 1972 - 11 Jan. 1973
Jerry W. Moody, Robert M. Sandfort, Roger W. Shaw, and Richard J. Janowiecki 11 Feb. 1973 72 p refs
(Contract DAAH01-72-C-1098; ARPA Order 1999)
(AD-755546; MRC-SL-354) Avail: NTIS CSCL 20/2

The object of this project is to establish a reliable supply of high quality magnetic bubble materials to support the device work of various Department of Defense agencies. This work encompasses bulk, non-magnetic garnet crystal growth (for use as substrates), substrate polishing and preparation, liquid phase epitaxial growth of high performance magnetic garnet film compositions, chemical vapor deposition of Ga-YIG films, and the investigation of arc-plasma spraying as a technique for preparing magnetic bubble garnet films. Characterization data are given for materials delivered during this phase. Author (GRA)

N73-22706# North American Rockwell Corp., Anaheim, Calif. Electronics Group.
FUNDAMENTAL STUDIES OF SEMICONDUCTOR HETEROEPITAXY Semiannual Report, Jul. - Dec. 1972
Ralph P. Ruth, A. James Hughes, Joseph L. Kenty, Harold M. Manasevit, and Arthur C. Thorsen Jan. 1973 112 p refs
(Contract DAAH01-70-C-13111; ARPA Order 1585)
(AD-755529; C71-86.5/501; SAR-5) Avail: NTIS CSCL 20/12

The objective of this program is to carry out a fundamental study of nucleation and film growth mechanisms in heteroepitaxial semiconductor thin films, and to apply the results to the preparation of improved films and thin-film devices on insulating substrates. Both theoretical and experimental investigations are involved with emphasis on chemical vapor deposition (CVD) techniques applied to the Si/Al2O3, Si/MgAl2O4, and GaAs/Al2O3 systems. The accomplishments of the fifth six-month period are described in terms of seven program subtasks. Author (GRA)

N73-22707# Hewlett-Packard Co., Palo Alto, Calif.
MAGNETIC RARE EARTH COMPOUNDS 3 Semiannual Technical Report, 14 Jun. - 14 Dec. 1972
Robert A. Burmeister and Ronald Hiskes Jan. 1973 54 p refs
(Contract DAAH01-72-C-0996; ARPA Order 1627)
(AD-755165) Avail: NTIS CSCL 20/2

The magnetically uniaxial rare earth iron garnet (Gd,Y,Yb)3(Ga,Fe)5O12 has been grown on (111) Gd3Ga5O12 substrates. The liquid phase expitaxial dipping technique with horizontal substrate rotation has been employed in conjunction with PbO-B2O3 and BaO-B2O3-BaF2 solvents in the temperature range of 900C-1050C. Growth parameters in the BaO-based solvent, such as growth temperature, undercooling, and rotation rate, have been correlated with changes in growth rate and properties of the films. The films have been characterized with respect to composition, impurity content, lattice parameter, optical properties and magnetic properties. Author (GRA)

N73-22708# State Univ. of New York, Albany. Research Foundation.
RADIATION DAMAGE IN SEMICONDUCTORS Final Report, 1 Oct. 1969 - 31 May 1972
James W. Corbett 31 Aug. 1972 70 p refs
(Contract F19628-70-C-0062; AF Proj. 6096)
(AD-756907; AFCRL-72-0574) Avail: NTIS CSCL 20/12

The work on radiation damage in semiconductors carried out at SUNY/Albany is described. The work is primarily on EPR spectra observed in neutron irradiated silicon. The observation of seven new spectra is discussed including their behavior on annealing (with and without a uniaxial stress). The photo response of EPR spectra is considered. The identification of a major center, the P-1 center, is established as the negative charge state of a five-vacancy center. Author (GRA)

N73-22709# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURE AND OPTICAL PROPERTIES OF THIN FILMS OF THE HgTe-CdTe
B. F. Bilenkii, R. V. Gerasimchuk, M. V. Pashkovskii, V. G. Saviskii, and A. K. Filatova 5 Feb. 1973 11 p refs Transl. into ENGLISH from Tr. Akad. Nauk Litovski SSR, Inst. Fiz. Poluprov. (Vilna), no. 3, 1970 p 192-196
(AD-756093; FTD-HT-23-1829-72) Avail: NTIS CSCL 20/12

Optical absorption spectra of HgTe-CdTe thin films were measured at room temperature in the ultraviolet, infrared, and visible regions. It is shown that the fundamental absorption edge shifts toward the short-wavelength region of the spectrum with increasing tellurium content in the system. Films deposited on KCl and KBr substrates exhibited a textured transmission. Spectra for the films are illustrated. Author (GRA)

N73-22479 Joint Publications Research Service, Arlington, Va.
PLASTIC GROWTH OF CRACKS
Yu. I. Poliektov and V. V. Rybin *In its* Selected Transl. on Met. 30 Mar. 1973 p 9-25 refs (For availability see N73-22477 13-17)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-22710* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF FORMING DIFUNCTIONAL POLYISOBUTYLENE Patent
Joseph A. Miller, Jr., inventor (to NASA) Issued 11 Jan. 1972 3 p Filed 28 Jul. 1969 Supersedes N70-11130 (08 - 01, p 0165)
(NASA-Case-NPO-10893; US-Patent-3,634,383;
US-Patent-Appl-SN-845584; US-Patent-Class-260-94.8) Avail: US Patent Office CSCL 21I

A method for producing polyisobuytylene compounds for application as solid propellant rocket binders is discussed. The chemical reaction is described and illustrated. The restrictions to be observed during the chemical reaction are discussed. The properties of the resulting material are analyzed. P.N.F.

N73-22711*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY APPRAISAL OF HYDROGEN AND METHANE FUEL IN A MACH 2.7 SUPERSONIC TRANSPORT
John B. Whitlow, Jr., Richard J. Weber, and Kestutis C. Civinskas [1972] 51 p refs Prepared in cooperation with Army Air Mobility R and D Lab. Cleveland
(NASA-TM-X-68222; E-7425) Avail: NTIS HC $4.75 CSCL 21D

The higher heating value of hydrogen relative to JP fuel is estimated to reduce fuel weight by three fold and gross weight by 40 percent for comparable designed airplanes of equal payload and range. Engine design parameters were varied to determine the influence of lower noise goals on gross weight and direct operating cost. At current fuel prices, the DOC of a hydrogen airplane would be much higher than that of a JP airplane. A methane airplane could offer an 8.5-percent lower KOC than

JP. But future shortages may escalate the prices of both JP and methane, whereas the price of hydrogen manufactured hydrolytically could be reduced from present levels. If in the future all three fuels are postulated to have equal costs per unit of energy, the DOC for hydrogen could be as much as 20 percent below that for JP on the reference 4000-nautical-mile mission. Longer ranges or lower noise requirements would improve the advantage of hydrogen. Author

N73-22712# British Aircraft Corp. (Operating) Ltd., Bristol (England).
A STUDY OF MATERIALS COMPATIBILITY WITH HYDRAZINE, PART 2
W. Berry, I. M. Gibbon, R. Doling, and D. R. Saw Paris ESRO Aug. 1972 134 p refs
(Contract ESTEC-828/69-Pt-2)
(ESRO-CR-85-Pt-2) Avail: NTIS HC $8.75

The decomposition rates of hydrazine in contact with various metals and rubbers were measured. The metals included titanium and nickel alloys, tungsten carbide, aluminum, and stainless steels. The rubbers were butyl and ethylene-propylene. Compatibility tests involving dissimilar metals in contact were also carried out and the effects of carbonic acid on compatibility investigated. Tests on a spacecraft propellant tank filled with hydrazine to 50% ullage are also described. ESRO

N73-22713# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Chemical Hazards Branch.
EVALUATION OF METHODS FOR THE DETECTION OF FLUORINE-CONTAINING MISSILE OXIDIZERS Final Report, May - Jun. 1971
George M. Frame, II Nov. 1972 35 p refs
(AF Proj. 6302)
(AD-756525; AMRL-TR-71-118) Avail: NTIS CSCL 07/2

The prospects for development of dosimeter badges and portable detection devices capable of measuring part per million levels of NF3, N2F4, ClF3, and OF2 have been assessed. A survey of the relevant physical and chemical properties of these compounds, their analytical chemistry, and instrumental methods for their detection is presented. Despite the great energy of reaction released when these compounds function as oxidizers in rocket engines, they are kinetically quite inert at ambient temperatures and part per million dilution. It is recommended that oxidizing reactions yielding F(-) by reaction of the oxidizers with Br(-) and I(-) be tested under the above conditions. If successful, a dosimeter should be constructed using either the Cerium/Lanthanum-Alizarin Fluorine Blue color reaction or the fluoride specific ion electrode. The recommended instrumental techniques for developing a portable detectro are electron-capture gas chromatography and pulsed-leak quadrupole mass spectrometry. Author (GRA)

N73-22714# Army Missile Command, Redstone Arsenal, Ala.
AUTOMATED MECHANICAL PROPERTY DATA PROCESSING SYSTEM
Donald L. Martin, Jr. 1 Oct. 1972 85 p refs
(DA Proj. 1M2-62303-A-214)
(AD-755515; RK-TR-72-21) Avail: NTIS CSCL 21/9

Significant improvements in data acquisition and reduction for mechanical property tests of composite solid propellants and binders have been realized by installation of an automated data processing system. The system is based on a small digital computer, and is assembled from both commercially available components and specially designed interfacing components. The program described in this report enables the system to automatically sample and record data from test instrumentation, to compute pertinent data, and to output the information in a usable form immediately upon completion of the test. This system provides a more efficient method of data reduction, reduces the possibility of human error, and provides the basis for extracting more information from test data than is feasible by manual methods. Author (GRA)

N73-22715# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
NON-ACOUSTIC COMBUSTION INSTABILITY OF COMPOSITE SOLID PROPELLANTS Scientific Report
Ted L. Wong 29 Dec. 1972 146 p refs
(Grant AF-AFOSR-1656-69; AF Proj. 9711)
(AD-755825; AFOSR-73-0266TR) Avail: NTIS CSCL 21/9

The non-acoustic but nevertheless oscillatory combustion of composite solid propellants was studied with burners in which L* could be increased or decreased during the course of a firing. A modular theory is suggested, and simplified for application to the data generated. Low-frequency, low-amplitude oscillations are not characteristic of the propellant only. Author (GRA)

N73-22716# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
LONG TERM STORAGE TESTING OF PROPELLANT TANKAGE Technical Report, period ending Jun. 1972
Howard M. White Dec. 1972 98 p refs
(AF Proj. 3058)
(AD-755383; AFRPL-TR-72-126) Avail: NTIS CSCL 21/9

The report concerns research on the performance of storable liquid system components and tankage under severe conditions of relative humidity and temperature. A variety of system components and tankage materials is being evaluated for long-term storability with liquid rocket fuels and oxidizers. Storage conditions are -85F temperature and 85 percent relative humidity for oxidizer systems, and -65F to -165F temperature and uncontrolled humidity for fuel systems. The propellants under test are N2O4, ClF5, N2H4, and MHF-5. Tankage materials under test are various alloys of aluminum, steel, and titanium. Tankage is joined by automatic and manual TIG, EB and solid-state bonding techniques. The results of almost four years of testing are presented. GRA

N73-22717# Boeing Co., Seattle, Wash. Aerospace Group.
A METHOD FOR THE PREVENTION OF N2O4 FLOW DECAY
Kent E. Pullen, T. Lynn Smith, and James P. Stebbins Dec. 1972 81 p refs
(Contract F04611-72-C-0040; AF Proj. 3058)
(AD-755380; D180-15161-1; AFRPL-TR-72-121) Avail: NTIS CSCL 21/9

The document discusses the results of a program whose objective was to formulate a method for preventing the occurrence of N2O4 flow decay. The method, which was successfully demonstrated, consisted of the removal of the flow decay causing contaminants (nitrate complexes of iron) from the N2O4 by distillation or filtration. The resulting iron-free N2O4 could be stored in contact with various alloys (even a ferrous alloy, such as 347 stainless steel) for substantial periods with no significant recontamination occurring. Author (GRA)

N73-22718# Utah Univ., Salt Lake City. Coll. of Engineering.
AN EXPERIMENTAL STUDY OF THE PRESSURE DISTRIBUTION IN BURNING FLAWS IN SOLID PROPELLANT GRAINS Final Report, 15 Mar. 1971 - 15 Aug. 1972
Harold R. Jacobs, Max L. Williams, and Dean B. Tuft Oct. 1972 67 p refs
(Contract F04611-71-C-0031)
(AD-756912; UTEC-DO-72-130; AFRPL-TR-72-108) Avail: NTIS CSCL 21/9

Cracks or flaws in solid propellant grains have been responsible for the failure of many rocket motors and there has been much concern in the solid propellant rocket industry as to the extent that flaws could contribute to catastrophic failure. The study was conducted to determine experimentally what the pressure distribution in a solid propellant debond would be after the burning had propagated into it. The bulk of the work was experimental with the results being compared to a computer solution for flow in a variable area duct with mass addition. Results are given for three separate debond angles at several different chamber pressures. With a knowledge of what the pressure distribution will be within a burning flaw, predictions can be made as to the probability of a flaw or crack contributing to catastrophic failure. Author (GRA)

N73-22719# Aerojet Liquid Rocket Co., Sacramento, Calif.
DYNAMIC COMPATIBILITY OF HALOGEN PROPELLANTS Final Report, 3 Jan. - 31 Aug. 1972
E. M. VanderWall, R. E. Anderson, R. L. Beegle, Jr., and J. A. Cabeal Dec. 1972 167 p refs
(Contract F04611-72-C-0031; AF Proj. 5730)
(AD-756916; AFRPL-TR-72-118) Avail: NTIS CSCL 21/9

The objective of this program was to establish design criteria on the dynamic compatibility of liquid and gaseous fluorine and chlorine pentafluoride with designated metals. Eleven metallic materials of construction were included in the program: 301 (cryoformed), 304L, 321 and 347 stainless steel; A-286 super alloy steel; 2219 and 6061 aluminum; OFHC copper; Monel K-500; Inconel 718; and Nickel 200. Six tests were used to obtain the data required to establish the design criteria: (1) maximum velocity, (2) adiabatic compression (U-tube), (3) liquid impact, (4) flexing/film degradation, (5) vibration/film degradation, (6) liquid phase shock wave. An extensive literature survey and critical review were conducted in conjunction with the experimental portion of the program. Author (GRA)

N73-22720# Picatinny Arsenal, Dover, N.J.
ON THE IGNITION AND DEFLAGRATION OF NITROCELLULOSE BASED SOLID PROPELLANT
Nam P. Suh (Mass. Inst. of Technol.), Jean-Paul Picard, and Charles Lenchitz Dec. 1972 26 p refs Presented at Collogue sur la Combust. des Properges Solides, Poitiers, France, 26-27 Oct. 1972
(DA Proj. 1T0-61102-A-326)
(AD-756880; PA-TM-2064) Avail: NTIS CSCL 21/9

An overall picture of the ignition and deflagration mechanisms of nitrocellulose-based propellants is presented. It is shown that the propellant behaves as an inert solid during the pre-ignition heating stage. The solid phase reaction becomes important during the steady state deflagration at low pressures, especially in single-base propellants because of its slow gas phase reactions. Both during the ignition and deflagration process the heat transported from the gas phase reaction zones to the solid surface sustains the decomposition of the solid phase. The mode of heat transfer between the gas phase zones and the solid phase reactions is discussed, including the contribution of the thermomechanical effects. A number of speculative deductions are made which may be investigated in the future. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-22721*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISHED ION THRUSTER GRIDS Patent Application
Bruce A. Banks, inventor (to NASA) Filed 18 Apr. 1973 11 p
(NASA-Case-LEW-11694-1; US-Patent-Appl-SN-352381) Avail: NTIS HC $3.00 CSCL 21C

A process for forming curved grids for an ion thruster accelerator system is discussed. The process fabricates matched pairs of dished grids having a high percentage of open areas. The matched pairs of dished screen and accelerator grids have space variations of less than one tenth of a millimeter. NASA

N73-22722*# Rocketdyne, Canoga Park, Calif.
LOW SPEED INDUCERS FOR CRYOGENIC UPPER STAGES Milestone Report
J. A. King 19 Jan. 1973 159 p
(Contract NAS8-29189)
(NASA-CR-124233; ASR-73-25) Avail: NTIS HC $10.00 CSCL 21H

Briefing charts are presented, which were used in an oral presentation of the results and recommendations for the design and analysis of low speed hydrogen and oxygen inducers and their drive systems applicable to the space tug. A discussion of the design of the 15K and RL-10 inducers is included. F.O.S.

N73-22723# Carleton Univ., Ottawa (Ontario).
AXIAL FLOW COMPRESSOR ANALYSIS USING A MATRIX METHOD
W. R. Davis and D. A. J. Millar Feb. 1973 92 p refs Revised
(ME/A-73-1) Avail: NTIS HC $6.75

A matrix technique, which calculates the inviscid, rotational, compressible axisymmetric flow field through an axial flow compressor, is described. Both enthalpy and entropy gradients are permitted; and an empirical cascade model of total pressure loss and deviation angle which is a function of blade geometry and inlet conditions is integrated into the calculation procedure. A FORTRAN computer program, which will analyse multistage transonic axial flow compressors of a specified geometry using the above technique is described and documentation given.
Author

N73-22724*# General Electric Co., Philadelphia, Pa. Space Div.
NUCLEAR ELECTRIC PROPULSION MISSION ENGINEERING STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Mar. 1973 24 p Prepared for JPL
(Contracts NAS7-100; JPL-953104)
(NASA-CR-131599; Doc-73SD4219-Vol-1) Avail: NTIS HC $3.25 CSCL 21F

Results of a mission engineering analysis of nuclear-thermionic electric propulsion spacecraft for unmanned interplanetary and geocentric missions are summarized. Critical technologies associated with the development of nuclear electric propulsion (NEP) are assessed. Outer planet and comet rendezvous mission analysis, NEP stage design for geocentric and interplanetary missions, NEP system development cost and unit costs, and technology requirements for NEP stage development are studied. The NEP stage design provides both inherent reliability and high payload mass capability. The NEP stage and payload integration was found to be compatible with the space shuttle.
Author

N73-22725*# General Electric Co., Philadelphia, Pa. Space Div.
NUCLEAR ELECTRIC PROPULSION MISSION ENGINEERING STUDY. VOLUME 2: FINAL REPORT
Mar. 1973 263 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953104)
(NASA-CR-131600; Doc-73SD4220-Vol-2) Avail: NTIS HC $15.25 CSCL 21F

Results of a mission engineering analysis of nuclear-thermionic electric propulsion spacecraft for unmanned interplanetary and geocentric missions are summarized. Critical technologies associated with the development of nuclear electric propulsion (NEP) are assessed, along with the impact of its availability on future space programs. Outer planet and comet rendezvous mission analysis, NEP stage design for geocentric and interplanetary missions, NEP system development cost and unit costs, and technology requirements for NEP stage development are studied. Author

N73-22726*# Rocketdyne, Canoga Park, Calif.
INJECTOR DESIGN GUIDELINES FOR GAS/LIQUID PROPELLANT SYSTEMS
A. Y. Falk and R. J. Burick May 1973 90 p refs
(Contract NAS3-12051)
(NASA-CR-120968; R-8973-3) Avail: NTIS HC $6.50 CSCL 21H

Injector design guidelines are provided for gas/liquid propellant systems. Information was obtained from a 30-month applied research program encompassing an analytical, design, and experimental effort to relate injector design parameters to simultaneous attainment of high performance and component (injector/thrust chamber) compatibility for gas/liquid space storable propellants. The gas/liquid propellant combination studied was FLOX (82.6% F2)/ ambient temperature gaseous methane. Design criteria that provide for simultaneous attainment of high performance and chamber compatibility are presented for both injector types. Parametric data are presented that are applicable for the design of circular coaxial and like-doublet injectors that operate with design parameters similar to those employed. However, caution should be exercised when applying these data to propellant combinations whose elements operate in ranges considerably different from those employed in this study. Author

N73-22727*# AiResearch Mfg. Co., Los Angeles, Calif.
HIGH-TIP-SPEED, LOW-LOADING TRANSONIC FAN

STAGE. PART 1: AERODYNAMIC AND MECHANICAL DESIGN
L. C. Wright, N. G. Vitale, T. C. Ware, and J. R. Erwin Apr. 1973 180 p refs
(Contract NAS3-13498)
(NASA-CR-121095; AiResearch-72-8421-Pt-1) Avail: NTIS HC $11.00 CSCL 21E

A high-tip-speed, low-loading transonic fan stage was designed to deliver an overall pressure ratio of 1.5 with an adiabatic efficiency of 86 percent. The design flow per unit annulus area is 42.0 pounds per square foot. The fan features a hub/tip ratio of 0.46, a tip diameter of 28.74 in. and operates at a design tip speed of 1600 fps. For these design conditions, the rotor blade tip region operates with supersonic inlet and supersonic discharge relative velocities. A sophisticated quasi-three-dimensional characteristic section design procedure was used for the all-supersonic sections and the inlet of the midspan transonic sections. For regions where the relative outlet velocities are supersonic, the blade operates with weak oblique shocks only. Author

N73-22728# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RADIAL BALANCE IN TURBOMACHINE FLOWS
Robert Legendre 1973 31 p refs In FRENCH; ENGLISH summary
(ONERA-NT-209) Avail: NTIS HC $3.75

The methods for calculating the radial balance in turbomachinery currently used in industry are reviewed. The mass force concept, introduced to represent the action exerted by the blades on the fluid is considered too intuitive for good accuracy. The critical survey, based formally on fluid mechanics equations, justifies the use of this concept. While setting limits for its validity, it also leads to the establishment of general equations for calculating a reference isentropic flow. It is shown that it is still much more useful to adapt the new calculation for predicting the flow with increasing entropy. Author

N73-22729*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SIMPLIFIED FUEL CONTROL APPROACH FOR LOW COST AIRCRAFT GAS TURBINES
Harold Gold 26 Apr. 1973 32 p refs Presented at Natl. Air Transportation Meeting, Miami, Fla., 24-26 Apr. 1973; sponsored by the Soc. of Automotive Engr.
(NASA-TM-X-68229; E-7254) Avail: NTIS HC $3.75 CSCL 21E

Reduction in the complexity of gas turbine fuel controls without loss of control accuracy, reliability, or effectiveness as a method for reducing engine costs is discussed. A description and analysis of hydromechanical approach are presented. A computer simulation of the control mechanism is given and performance of a physical model in engine test is reported. Author

N73-22730# Federal Aviation Administration, Washington, D.C.
AIRCRAFT ENGINE TYPE CERTIFICATION HANDBOOK
5 Jun. 1972 40 p
(FAA-AC-33-2A) Avail: NTIS HC $4.00

Information and guidance for the type certification of aircraft engines as required by the Federal Aviation Administration of the Department of Transportation are presented. The subjects discussed are: (1) general type certification procedures, (2) type certificate data sheet, (3) engine specifications, (4) installation considerations, (5) engine changes which affect installations, (6) official engine tests, (7) processing changes in type design, and (8) selection of engine power and thrust ratings. Author

N73-22731# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DISTORTION DATA ANALYSIS Final Report, Feb. - Nov. 1972
Michael T. Moore Feb. 1973 144 p refs
(Contract F33615-72-C-1763; AF Proj. 3066)
(AD-756481; AFAPL-TR-72-111) Avail: NTIS CSCL 21/5

A detailed study of the characteristics of inlet distortion has been conducted. Data was selected from inlet and engine/inlet tests with various duct diameters and various levels of steady-state distortion. A similarity parameter was developed which showed consistent trends in dynamic distortion relative to steady-state distortion over different scale sizes. These trends were consistent when the GE Method D Phase O Distortion Parameter, ID, was used and not when gross overall distortion parameters were used. Author (GRA)

N73-22732# ARO, Inc., Arnold Air Force Station, Tenn.
AN ANALYTICAL STUDY OF HYPERSONIC INLETS IN FREE MOLECULE FLOW Final Report, Aug. 1971 - Jun. 1972
Max Kinslow and M. R. Busby AEDC Feb. 1973 27 p refs Sponsored by AEDC
(ARO Proj. BE2256)
(AD-756680; ARO-VKF-TR-72-202; AEDC-TR-73-25) Avail: NTIS CSCL 21/3

A report is made of an analytical study of free-molecule, hypervelocity air inlet configurations which might be used to supply gas for ion engines aboard satellites. The basic equations for the inlet are developed based upon gas-surface interactions. These equations are numerically solved for various gas-surface interaction parameters. Based upon these inlets, ion rocket performance is determined for various efficiencies. Author (GRA)

N73-22733# ARO, Inc., Arnold Air Force Station, Tenn.
HANDBOOK, UNCERTAINTY IN GAS TURBINE MEASUREMENTS Final Report
R. B. Abernathy (Pratt and Whitney, Aircraft), Billy D. Powell (Pratt and Whitney Aicraft), David L. Colbert (Pratt and Whitney Aircraft), Daniel G. Sanders (Pratt and Whitney Aircraft), and J. W. Thompson, Jr. (Pratt and Whitney Aircraft) AEDC Feb. 1973 180 p
(Contract F40600-73-C-0004)
(AD-755356; ARO-ETF-TR-60; AEDC-TR-73-5) Avail: NTIS CSCL 21/5

The lack of a standard method for estimating the errors associated with gas turbine performance data has made it impossible to compare measurement systems between facilities, and there has been confusion over the interpretation of error analysis. Therefore, a standard uncertainty methodology is proposed in this Handbook. The mathematical uncertainty model presented is based on two components of measurement error: the fixed (bias) error and the random (precision) error. The result of applying the model is an estimate of the error in the measured performance parameter. The uncertainty estimate is the interval about the measurement which is expected to encompass the true value. The propagation of error from basic measurements through calculated performance parameters is presented. Traceability of measurement back to the National Bureau of Standards and associated error sources is reviewed. Author (GRA)

N73-22734# Naval Postgraduate School, Monterey, Calif.
THREE-DIMENSIONAL FINITE ELEMENT STUDIES. PART 1: SERVICE ROUTINES
Gilles Cantin Dec. 1972 70 p refs
(AD-755539; NPS-59C172121A-Pt-1) Avail: NTIS CSCL 21/8

In the report, service routines are developed for linear, quadratic and cubic finite elements for two- and three-dimensional regions. Also, an equation solver of very large capacity is developed for systems of linear equations where the matrix of coefficients is symmetrical, positive definite and tightly banded along the main diagonal. Author (GRA)

N73-22735# Marquardt Corp., Van Nuys, Calif.
WATER ELECTROLYSIS SATELLITE PROPULSION SYSTEM Final Report, Jul. 1971 - Oct. 1972
R. Carl Stechman and John G. Campbell Jan. 1973 248 p refs
(Contract F04611-71-C-0055; AF Proj. 3058)
(AD-755384; MR-S-1247; AFRPL-TR-72-132) Avail: NTIS CSCL 21/8

A water electrolysis satellite propulsion system capable of providing 100,000 pound-seconds of impulse during a seven year life was fabricated and tested in three modes of operation -- simple blowdown, helium repressurization and repressurization by oxygen in a feedback mode. The tests verified the systems

predicted capabilities in all three modes at generation rates of 0 to 2.3 lbs/day of propellant, with an electrical energy conversion efficiency of up to 82%. A 5.0 pound thrust and a 0.1 pound thrust GO2/GH2 engine were tested as separate components with measured specific impulses of 345 and 330 seconds, respectively, at a mixture ratio of 8. The 0.1 pound engine accumulated 14,330 seconds of burn time and 151,263 ignitions, while the 5 pound thrust engine attained 10,031 seconds of burn time and 69,700 ignitions. The demonstrated overall performance of the system and engines shows its applicability to satellite and spacecraft which require high performance, reliable operation, and long life capabilities. Author (GRA)

N73-22736# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LONGITUDINAL VIBRATIONS OF ROCKETS WITH LIQUID FUEL ENGINES
K. S. Kolesnikov 4 Jan. 1972 329 p refs Transl. into ENGLISH from the monograph "Prodolnye Kolebaniya Rakety s Zhidkostnym Raketnym Dvigatelem" USSR, 1971 p 1-260
(AD-756076; FTD-HC-23-1198-72) Avail: NTIS CSCL 21/8

In the report vibrations in the powered-flight phase of a liquid fuel rocket are examined as a closed mechanical-hydraulic system consisting of the elastic body of the rocket with liquid fuel in tanks, fuel lines, and liquid rocket engine. The dynamic characteristics of each of these elements of the system are examined. Methods of calculating the form and frequencies of inherent longitudinal vibrations of the body of the rocket are presented, taking into account the axisymmetrical vibrations of the elastic fuel tanks. The dynamic characteristics of the fuel lines are determined with a consideration of the local resistances and elastic properties of the turbo-drives and bellows, taking into account the compressibility and cavitation of the liquid fuel entering the centrifugal pumps. The low-frequency dynamic characteristics of the liquid propellant rocket engine are determined with closed and open feeding system. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-22737 International Geophysical Year World Data Center A, Boulder, Colo.
DATA ON SOLAR-GEOPHYSICAL ACTIVITY ASSOCIATED WITH THE MAJOR GROUND LEVEL COSMIC RAY EVENTS OF 24 JANUARY AND 1 SEPTEMBER 1971, PART 1
Helen E. Coffey, comp. and J. Virginia Lincoln, comp. Dec. 1972 305 p refs
(UAG-24-Pt-1) Avail: National Climatic Center, Federal Building, Asheville, NC 28801, Attn: Publications HC $2.00

Papers are presented for the solar cosmic ray event of 24 January 1971. Topics discussed include the solar region of January 1971, solar radio events, space observations, cosmic rays, ionosphere, aurora, and geomagnetism. F.O.S.

N73-22738 International Geophysical Year World Data Center A, Boulder, Colo.
DATA ON SOLAR-GEOPHYSICAL ACTIVITY ASSOCIATED WITH THE MAJOR GROUND LEVEL COSMIC RAY EVENTS OF 24 JANUARY AND 1 SEPTEMBER 1971, PART 2
Helen E. Coffey, comp. and J. Virginia Lincoln, comp. Dec. 1972 168 p refs
(UAG-24-Pt-2) Avail: National Climatic Center, Federal Building, Asheville, NC 28801, Attn: Publications HC $2.00

Papers are presented for the major solar cosmic ray event of 1 September 1971. Topics discussed include the solar region of September 1971, solar radio events, space observations, cosmic rays, ionosphere, aurora, and geomagnetism. F.O.S.

N73-22739 Harvard Univ., Cambridge, Mass.
INTERACTIONS OF COSMIC RAYS WITH HYDROMAGNETIC WAVES IN THE GALAXY Ph.D. Thesis
Catherine Jeanne Cesarsky 1972 122 p
Avail: Univ. Microfilms Order No. 72-12716

The possibility that ultrarelativistic cosmic rays are confined to the galactic disk as a result of their interactions with hydromagnetic waves is examined. Turbulent gas motions in the galaxy are a possible source of long hydromagnetic waves, with wavelengths of the order of a few parsecs. By analogy with hydrodynamic turbulence, we assume that nonlinear effects cause the energy in these long waves to be transmitted to waves of successively smaller size. This process, together with the different mechanisms tending to damp the waves, determines the wave spectrum. The diffusion of cosmic rays in the presence of given spectrum of hydromagnetic waves is parameterized by their mean free path, lambda. Cosmic rays are scattered in pitch angle by their resonant interactions with hydromagnetic waves; they are also mirror reflected by magnetosonic (or magnetoacoustic) waves. Both effects have to be considered in the evaluation of lambda. A model for the propagation of cosmic rays in the galaxy is proposed, in which cosmic rays traverse the gas disk, of thickness 300 pc, at large speeds, but diffuse slowly in 2 slabs of hot and diffuse gas, 200 pc thick, at each side of the gas disk. It is shown that the predictions of this model agree with the available observations. Dissert. Abstr.

N73-22740 Wyoming Univ., Laramie.
A DYNAMICAL MODEL OF THE SOLAR CORONA Ph.D. Thesis
Stephen Laurence Browne 1972 185 p
Avail: Univ. Microfilms Order No. 72-26502

The hydrodynamic equations for an ideal, inviscid, fully ionized hydrogen gas in a gravitational, but not magnetic, field are solved by an explicit Lax-Wendroff two-step technique using one-dimensional slab symmetry. Radiation and thermal conductivity are included. The model spans 100,000 km starting from the chromosphere-corona transition region. An initially isothermal gas is seen to evolve coronal properties in 4000 seconds, by which time it settles into dynamic equilibrium characterized by a 2000 km transition region, a temperature maximum of 1.6 .x one million K at a height of 60,000 km, and a solar wind mass flux of 10 to the minus 9th power gm/cm2 sec. Dissert. Abstr.

N73-22741 Johns Hopkins Univ., Baltimore, Md.
THE FAR ULTRAVIOLET SPECTRUM OF VENUS Ph.D. Thesis
Gary James Rottman 1972 185 p
Avail: Univ. Microfilms Order No. 72-24978

An ultraviolet spectrum of the planet Venus was obtained from a sounding rocket launched on 25 January 1971. The instrument used to obtain this spectrum consisted of an accurately pointed Dall-Kirkham telescope and an entrance slitted LiF prism spectrophotometer. The preparation of the experiment and a spectroscopic analysis of the data are presented. The spectrum of Venus shows clear emission features of both atomic and molecular species. The 1216 A line of atomic hydrogen, the 1304 A and 1356 A lines of atomic oxygen, and the 1561 A and 1657 A lines of atomic carbon appear as distinct atomic emission features of the spectrum. The carbon monoxide fourth positive band system is also clearly identified. A computer program was designed to simulate the response of the flight spectrometer and was used to generate spectra of complex molecular band emissions for comparison with the spectrum of Venus.
Dissert. Abstr.

N73-22742 Boston Univ., Mass.
A DYNAMIC MODEL OF SOLAR FLARES Ph.D. Thesis
Federico M. Strauss 1972 140 p
Avail: Univ. Microfilms Order No. 72-25339

A theoretical study of the time development of the sources of X-rays, microwave bursts, and chromospheric radiation of solar flares is formulated and compared with observations. The specific model adopted for the geometry of the flaring region is due to P. A. Sturrock. The observations indicate that at least two regions with different characteristics have to be considered. The evolution of a plasma contained by the magnetic field of the loops was studied in two extreme cases, namely at constant pressure and at constant density. The resulting partial differential equations were solved numerically, and the predicted X-ray emission of the hot plasma was compared with the observations, made with the OGO-5 satellite, of two flares. Both cases give

very similar results, and agree within a factor of two with the data. Dissert. Abstr.

N73-22743 Cornell Univ., Ithaca, N.Y.
RESULTS OF THE CORNELL MULTIJOULE AIR SHOWER ATMOSPHERIC FLUORESCENCE EXPERIMENT Ph.D. Thesis
James Curtis Ahlstrom 1972 118 p
Avail: Univ. Microfilms Order No. 72-26339

In order to study the arrival direction and energy spectrum of extremely high energy cosmic rays, an attempt was made to detect the atmospheric fluorescence light generated by the particles in an extensive air shower. The apparatus is essentially a camera with a mosaic of photomultiplier tubes in the focal surface of a fresnel lens. Since the expected signal levels are so low (fluorescence conversion efficiency is 0.004%) the apparatus can only be run on clear moonless nights, limiting the running time to 17% at most. No events were found which could be uniquely attributed to scintillation light from an extensive air shower. A computer program was developed to clarify the nature of the received signals and to estimate the event rate. The observed and expected event rates are in agreement. A general discussion of the utility of this method of extensive air shower study is presented. Dissert. Abstr.

N73-22744 Iowa Univ., Iowa City.
ANISOTROPIES IN 0.3 MeV SOLAR PROTONS Ph.D. Thesis
William Glen Innanen 1972 176 p
Avail: Univ. Microfilms Order No. 72-26696

A study of 0.3 to 6.3 MeV solar proton anisotropies in interplanetary space was made from Explorer 35 solid state detector data. From August 9, 1967, to July 12, 1970, 15 events were observed essentially clear of magnetospheric influences, and 9 of these were simple events (i.e., primarily due to a single solar flare). For these 9 events the heliocentric radial component of the anisotropy, integrated over each event, yields the total number of 0.3 to 6.3 MeV protons flowing past the spacecraft expressed as the number of protons per unit solid angle passing outward through a spherical surface of radius 1 AU centered on the sun. These values range from 10 to the 33rd power to 10 to the 35th power protons/sr. It is concluded that the 0.3 MeV solar proton anisotropy is primarily composed of two components: a radial anisotropy caused by convection of the protons by the solar wind which predominates during the decay phase of an event, and a field aligned component due to diffusion which predominates in the rise phase of an event. Dissert. Abstr.

N73-22745*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
TRANSVERSE LOW FREQUENCY WAVE IN A TWO FLUID SOLAR WIND M.S. Thesis
Gradi Vincent Solodyna 19 Jan. 1973 61 p refs
(Grant NGL-22-009-015; NSF GP-31378)
(NASA-CR-131570; CSR-T-73-1) Avail: NTIS HC $5.25 CSCL 03B

Investigation is made of the properties of low frequency transverse waves in a two-fluid solar wind having a radial magnetic field and radial streaming velocity. In order to examine what effects this streaming medium has on the waves, linearly polarized waves are decomposed into left and right circularly polarized waves. Computation is made of analytic expressions valid to first order for the radial amplitude and phase dependence of these constituent waves. It is shown that after travelling a given distance r, these waves have different amplitudes and phases. The former result causes their superposition to become elliptical rather than linear. The latter causes the axis of the ellipse of polarization to rotate through a well-defined angle. Analytic expressions are obtained for the eccentricity of the ellipse and for the angle of rotation. In analogy with regular Faraday rotation, in which the plane of polarization of a linear polarized wave rotates, the effect is denoted as generalized Faraday rotation. Author

N73-22746*# TRW Systems Group, Redondo Beach, Calif. Space Sciences Dept.
THEORETICAL ANALYSIS OF WAVE-PARTICLE INTERACTIONS IN THE MAGNETOSPHERE AND SOLAR WIND Final Report
15 Apr. 1973 14 p refs
(Contract NASw-2357)
(NASA-CR-131573; TRW-22935-6004-RU-00) Avail: NTIS HC $3.00 CSCL 03B

The theoretical calculation of a beam-plasma interaction, and theoretical calculations on high power antenna-plasma coupling are discussed along with the polar cusp-magnetosheath interface. F.O.S.

N73-22747*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THE RADIATION MONITOR COSMIC X-RAY EXPERIMENT OSO-1 Final Project Report
Roger F. Randall 1 Mar. 1973 139 p
(Contract NAS5-23112)
(NASA-CR-130206) Avail: NTIS HC $9.00 CSCL 03B

A comprehensive technical description is presented of the Radiation Monitor which is part of the GSFC cosmic X-ray experiment to be flown on the OSO-1 satellite. The theory of operation, fabrication and assembly, and cone angle determination are reported. Author

N73-22748*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE UTILIZATION OF SOLAR ENERGY TO HELP MEET OUR NATION'S ENERGY NEEDS
Ronald L. Thomas 1973 37 p refs Presented at Energy Crisis Symp., Albuquerque, 3-4 May 1973; sponsored by Natl. Profess. Soc. of N. Mex.
(NASA-TM-X-68230; E-7439) Avail: NTIS HC $4.00 CSCL 10A

The nation's energy needs, domestic energy resources, and possible future energy resources are briefly discussed in this paper. Three potential solutions, coal, nuclear and solar are compared as to benefits and problems. The paper primarily discusses the options available in using solar energy as a natural energy resource. These options are discussed under the generation of electricity, heating and cooling of buildings, and the production of clean fuel. Author

N73-22749# Leeds Univ. (England).
CONTRIBUTIONS TO THE BRITISH UNIVERSITIES' EXTENSIVE AIR SHOWER PROJECT
1971 62 p refs Presented at the 12th Intern. Cosmic Ray Conf., Hobart, Australia, Aug. 1971
(HPNL-8) Avail: NTIS HC $5.25

The results of extensive cosmic ray shower observations using the Haverah Park (Britain) array are reported. The following topics are discussed: the primary energy spectrum of large air showers obtained from structure, size, and flux measurements; arrival directions and anisotropics of large air showers with primary energy larger than 100,000 TeV; and nuclear interaction models for air showers to determine lateral distribution of particles. For individual titles, see N73-22750 through N73-22757.

N73-22750 Leeds Univ. (England). Dept. of Physics.
THE ENERGY SPECTRUM OF LARGE AIR SHOWERS
D. Andrews, D. M. Edge, A. C. Evans, R. J. O. Reid, R. M. Tennent, A. A. Watson, J. G. Wilson, and A. M. Wray *In its* Contrib. to the Brit. Univ.'s Extensive Air Shower Proj. 1971 6 p refs Sponsored by Sci. Res. Council (For availability see N73-22749 13-29)

The primary energy spectrum of large air showers was derived from analyses of over 3000 showers of primary energies larger than 300,000 TeV recorded with Haverah Park detector array up to Jan. 1971. An upper limit of zenith angle, beyond which a circularly symmetric particle distribution is unacceptable, was established, to avoid geomagnetic distortion effects. The experimental results obtained from the structure function, shower size measurement, and shower flux measurement lead to an expression for the primary energy spectrum. ESRO

N73-22751 Leeds Univ. (England). Dept. of Physics.
ARRIVAL DIRECTIONS OF LARGE AIR SHOWERS OF PRIMARY ENERGY LARGER THAN 100,000 TeV
J. Lapikens, R. Martin, R. J. O. Reid, P. D. Robinson, R. M. Tennent, A. A. Watson, and J. G. Wilson *In its* Contrib. to the

Brit. Univ.'s Extensive Air Shower Proj. 1971 5 p refs Sponsored by Sci. Res. Council (For availability see N73-22749 13-29)

The analysis of air showers detected over the period July 1966 to July 1970 is presented, with regard to arrival directions and anisotropics for primary energies larger than 100,000 TeV. The results are summarized and show no significant first or second harmonics. The present energy range sets more stringent limits on anisotropics in right ascension. The data should enable more sophisticated models of galactic production and propagation to be tested. ESRO

N73-22752 Leeds Univ. (England). Dept. of Physics.
AIR SHOWER MODELS
A. M. Hillas, J. D. Hollows, H. W. Hunter, and D. J. Marsden *In its* Contrib. to the Brit. Univ.'s Extensive Air Shower Proj. 1971 12 p refs (For availability see N73-22749 13-29)

Lateral distributions of particles in air showers at axial distances up to 1.5 km were calculated for several models of nuclear interaction, giving a wide range of possible results for shower age and proportion of muons. The primary mass can not as yet be deduced from such data, but a change of mass with energy, if fairly rapid, should be clear. A useful form for presenting data on the proportion of muons in showers is suggested. Author (ESRO)

N73-22753 Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
RADIO FREQUENCY EMISSION FROM EXTENSIVE AIR SHOWERS
H. R. Allan, J. K. Jones, N. Mandolesi, J. H. Prah, and P. Shutie *In* Leeds Univ. Contrib. to the Brit. Univ.'s Extensive Air Shower Proj. 1971 9 p refs Sponsored in part by ESRO (For availability see N73-22749 13-29)

The total electric field strength at a ground antenna from cosmic ray shower radio emissions was plotted from measurements and calculations for the frequencies 32 MHz, 60 MHz, and 105 MHz. A formula was developed for calculating field strength, based on certain premises. The only unknown parameter was the maximum penetration depth into the atmosphere, which may be obtained from experimental distributions. The total field strength was plotted as a function of the perpendicular distance from the antenna to the shower axis from experimental data. Two graphs per frequency were obtained: one not taking into account changes in zenith angle, and one with a correction for zenith angle variations. ESRO

N73-22754 Durham Univ. (England). Dept. of Physics.
THE HEIGHTS OF ORIGIN OF MUONS IN LARGE AIR SHOWERS
J. C. Earnshaw, A. C. Machin, K. J. Orford, D. R. Pickersgill, and K. E. Turver *In* Leeds Univ. Contrib. to the Brit. Univ.'s Extensive Air Shower Proj. 1971 5 p refs Sponsored by Sci. Res. Council (For availability see N73-22749 13-29)

Information on the production altitude of muons was obtained from lateral and angular separation of muons from the shower core, and the geomagnetic distortion of the muon charge ratio at various points in the shower front. Measurements of the core angles and geomagnetic field both provide values of the mean height of origin of the muons which are in general accord with the longitudinal development of showers on many models. On the basis of data sampled during a 5 year period, it seems unlikely that either technique discussed will be able to distinguish unambiguously between the distribution in heights of muons expected for showers initiated by primary protons and heavy nuclei. ESRO

N73-22755 Durham Univ. (England). Dept. of Physics.
THE MOMENTUM SPECTRA OF MUONS AT HIGH MOMENTA IN LARGE AIR SHOWERS
J. C. Earnshaw, A. C. Machin, K. J. Orford, D. R. Pickersgill, and K. E. Turver *In* Leeds Univ. Contrib. to the Brit. Univ.'s Extensive Air Shower Proj. 1971 6 p refs Sponsored by Sci. Res. Council (For availability see N73-22749 13-29)

The momentum spectrum of muons between 100 and 600 m from the core of showers of primary energy around 100,000 TeV, measured with an improved resolution spectrometer, is reported. The data of this spectrum are limited statistically, but there is some confirmation using an unmodified spectrometer. This suggests an early development of the shower in the atmosphere, manifested by the presence of high momentum muons large distances from the shower core. The data were analyzed to show any dependence of the muon momentum spectra on shower primary energy, zenith angle, and arrival direction. ESRO

N73-22756 Nottingham Univ. (England). Dept. of Physics.
RESULTS FROM THE NOTTINGHAM MUON DETECTOR AT HAVERAH PARK
M. Armitage, P. R. Blake, H. Ferguson, A. Morley, W. F. Nash, and D. W. E. Thomas *In* Leeds Univ. Contrib. to the Brit. Univ.'s Extensive Air Shower Proj. 1971 12 p refs Sponsored by Sci. Res. Council (For availability see N73-22749 13-29)

Results and conclusions from the Nottingham 12.5 sq m cosmic ray air shower muon detector data are summarized. The detector having a muon threshold energy of 300 MeV is made up of three units. The arrival times of muons were measured with respect to the first detectable signal in the adjacent 34 sq m Cerenkov detector. A value for the spatial resolution of the flash-tube detectors when measuring muon densities was empirically derived and applied to the results in order to correct the observed densities. The spatial distribution of muons falling on the detector at distances larger than 200 m from the shower core was studied. The lateral density distribution of muons was measured as a function of shower size. The variation of the ratio of muon density to Cerenkov tank density was studied as a function of core distance and shower size. ESRO

N73-22757 Leeds Univ. (England). Dept. of Physics.
INVESTIGATION OF THE HADRONIC COMPONENT OF COSMIC RAYS
J. E. F. Baruch, G. Brooke, and E. W. Kellermann *In its* Contrib. to the Brit. Univ.'s Extensive Air Shower Proj. 1971 4 p refs Sponsored by Sci. Res. Council (For availability see N73-22749 13-29)

The performance of a 4 sq m calorimeter employing proportional counters in a crossed pattern and surrounded by air shower detectors was studied. The apparatus was found capable of determining the energies of single and individual components of multiple hadronic events with adequate resolution in the range from 1 to 10 TeV and of relating these nuclear counts to the size of accompanying showers. ESRO

N73-22758*# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
SOLAR GAMMA RAYS AND NEUTRON OBSERVATIONS
E. L. Chupp, D. J. Forrest (New Hampshire Univ.), and A. N. Suri (New Hampshire Univ.) Dec. 1972 33 p refs Presented at the Symp. on High Energy Phenomena on the Sun, Greenbelt, Md., 28-30 Sep. 1972
(Contract NAS5-11054; Grant NGL-30-002-021)
(NASA-CR-131866; MPI-PAE/Extraterr-77) Avail: NTIS HC $3.75 CSCL 03B

The present status of knowledge concerning the impulsive and the continuous emission of solar gamma rays and neutrons is reviewed in the light of the recent solar activity in early August 1972. The gamma ray spectrometer on OSO-7 has observed the sun continuously for most of the activity period except for occultation by the earth. In association with the 2B flare on 4 August 1972 and the 3B flare on 7 August 1972, the monitor provides evidence for solar gamma ray line emission in the energy range from 300 keV to 10 MeV. A summary of all the results available from preliminary analysis of the data will be given. Significant improvements in future experiments can be made with more sensitive instruments and more extensive time coverage of the sun. Author (ESRO)

N73-22759# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SOLAR PHOTOIONIZATION RATE CONSTANTS AND ULTRAVIOLET INTENSITIES Environmental Research Papers
Thomas J. Keneshea and Robert E. Huffman 16 Nov. 1972 23 p refs
(AF Proj. 5710)
(AD-756480; AFCRL-72-0667; AFCRL-ERP-420) Avail: NTIS CSCL 04/1

First-order rate constants for the photoionization of N2, O2, O, and NO are presented for the altitude region from 60 to 200 km. The latest available data on the solar flux and absorption and photoionization cross sections in the wavelength region from 1216.7 to 1A are used. Tables are presented for latitude 30 deg N at equinox at solar zenith angles of 30, 60, and 75 deg.
Author (GRA)

N73-22760# Aerospace Corp., El Segundo, Calif. Lab. Operations.
VALIDITY OF CGL EQUATIONS IN SOLAR-WIND PROBLEMS
Michael Schulz and Aharon Eviatar (Tel-Aviv Univ.) 31 Jan. 1973 20 p refs
(Contract F04701-72-C-0073)
(AD-756501; TR-0073(3260-20)-13; SAMSO-TR-73-44) Avail: NTIS CSCL 04/1

The double-adiabatic equations of state are derived algebraically from Liouville's theorem for an azimuthally symmetric proton exosphere throughout which the bulk velocity greatly exceeds the proton thermal velocities. The calculated skewing of the distribution function f(v) in the solar exosphere is found to agree qualitatively with observation and with the direction of heat flow inferred from dell T parallel. Author (GRA)

N73-22761# Air Force Weapons Lab., Kirtland AFB, N.Mex.
MEASUREMENTS OF GALACTIC COSMIC RAY DOSE AND GEOMAGNETICALLY TRAPPED RADIATION FROM THE OV1-4 SATELLITE
Christopher Kopf Feb. 1973 30 p refs
(AF Proj. 8803; AF Proj. 5877)
(AD-756924; AFWL-TR-72-187) Avail: NTIS CSCL 04/1

A highly sensitive tissue-equivalent ionization chamber was flown aboard the OV1-4 satellite, which was launched on 30 March 1966. The orbit was roughly circular with an apogee of 1019 kilometers and a perigee of 893 kilometers. The complete results from the ionization chamber are presented in geographic coordinates and geomagnetic B-L coordinates. Galactic cosmic ray and geomagnetically trapped dose rates were measured.
Author (GRA)

N73-22317* National Aeronautics and Space Administration, Washington, D.C.
GEOPHYSICAL EFFECTS OF THE X/28/1963 PROTON FLARE
G. N. Pushkova *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 41-46 refs (For availability see N73-22314 13-13)
CSCL 03B

N73-22329* National Aeronautics and Space Administration, Washington, D.C.
CHANGE OF E SUB s WITH THE 11 YEAR CYCLE OF SOLAR ACTIVITY
O. Ovezgeldyyev *In its* Ionosphere Disturbances and Their Influence on Radio Commun. Apr. 1973 p 280-296 refs (For availability see N73-22314 13-13)
CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-22762 Rice Univ., Houston, Tex.
EXPLOSIVE NUCLEOSYNTHESIS IN THE OUTER LAYERS OF STARS Ph.D. Thesis
William Michael Howard 1972 168 p
Avail: Univ. Microfilms Order No. 72-26422

Numerical integration is used to study the network of nuclear reactions that are expected to occur when the hydrogen and hydrogen-exhausted zones of a star are instantaneously heated and allowed to expand adiabatically, as might occur when a star undergoes a supernova explosion. The dependence of the results on nuclear cross sections, on the peak temperature, and on the time scale of hydrodynamic expansion are discussed. From stellar models, the density in the hydrogen rich envelope of the star appears too low for significant nuclear processing to occur. Of particular interest in the hydrogen exhausted zone is the result that the nucleus N-14, constituting about two percent by mass following the earlier operation of CNO cycle, is substantially converted to O-15, F-18, N-19 and Ne-21 in ratios close to the solar abundances of N-15, O-18, F-19 and Ne-21. Dissert. Abstr.

N73-22763 Rice Univ., Houston, Tex.
LUNAR ATMOSPHERE AND IONOSPHERE Ph.D. Thesis
Robert Hall Manka 1972 198 p
Avail: Univ. Microfilms Order No. 72-26449

To determine this interaction of lunar ions with electric and magnetic fields in the solar wind, the following characteristics of the lunar atmosphere and ionosphere are calculated: (1) The production of ions by photo- and charge-exchange ionization of lunar atmosphere; (2) the trajectory of these ions under acceleration of interplanetary electric and magnetic fields; (3) the energy and flux of ions which impact the moon; (4) the trapping efficiency for lunar ions which impact the lunar surface; and (5) the implied density in the neutral lunar atmosphere of certain species such as Ar-40. The effects of surface electric and magnetic fields upon ion acceleration are also considered. Applications of these calculations are made to data from lunar surface experiments and lunar sample analyses. Dissert. Abstr.

N73-22764 Rice Univ., Houston, Tex.
HARD X-RAY PULSARS Ph.D. Thesis
Frank Roderic Harnden, Jr. 1972 202 p
Avail: Univ. Microfilms Order No. 72-26417

Data obtained with balloon borne X-ray telescopes have been examined for evidence of pulsed X-radiation in the energy range from 30 to 950 keV. Reported here, along with some findings which have already been published, are three new results: (1) Hard X-rays have been observed from the region of the Gum nebula centered on the Vela pulsar; evidence is presented for (2) the first detection of PSR 0833-45 any wavelength other than radio, and (3) the measurement, nearly a year prior to the previously earliest measurement, of the period of the Crab nebula pulsar. A third object, Cygnus X-1, was not found to be periodically pulsating at any of the periods examined; but the time averaged flux has been determined, and upper limits have been placed on both periodic pulsations and short term fluctuations. Dissert. Abstr.

N73-22765 Cornell Univ., Ithaca, N.Y.
ABSOLUTE TIMING OF TWELVE PULSARS Ph.D. Thesis
David William Richards 1972 198 p
Avail: Univ. Microfilms Order No. 72-27969

Precision timing of several pulsars is initiated. An 1100-foot reflector was operated at frequencies between 111.5 and 430 MHz to measure absolute times of arrival from pulsars NP0527, NP0532, AP0823, CP0834, CP0950, CP1133, AP1237, AP1541, CP1919, PSR1929, JP1933 and AP2015. The intent of the observations was to obtain data necessary to determine periods, time derivatives of periods, and positions, where possible, in order to clarify the nature of pulsars. The pulse times-of-arrival (TOA's) were referenced to Loran-C signals of the U.S. Coast Guard and determined by cross correlation with templates representing assumed pulse shapes. The TOA's were reduced to the reference frame of the solar system barycenter and then fitted by least squares to a function assumed to describe pulse phase as a function of time, position error and other parameters. Dissert. Abstr.

N73-22766 Rice Univ., Houston, Tex.
MASS LOSS AND INFRARED EXCESSES IN STARS Ph.D. Thesis
Susan Louise Geisel Kleinmann 1972 148 p
Avail: Univ. Microfilms Order No. 72-26438

All of the stars with infrared excesses which have been observed spectroscopically belong to classes of stars which show evidence for large scale mass loss. The mechanisms by which these stars radiate excess infrared energy, and the physical

basis for the correlation between rapid mass loss and infrared excesses in stars are examined. A quantitative observational distinction between stars with infrared excesses and those without is proposed, and the list of all the stars now known, which are earlier than spectral type M, and which meet this observational criterion for excess infrared energy, is presented. The available UBV and infrared observations of these stars are summarized, and the available spectroscopic observations are briefly reviewed. Several mechanisms which might account for infrared excesses in stars are critically reviewed. Dissert. Abstr.

N73-22767 University of Southern Calif., Los Angeles.
PERTURBATIONS ON THE SUN, THE MOON AND THE ASPHERICITY OF THE EARTH'S GRAVITY FIELD ON A LOW ECCENTRICITY, LOW INCLINATION SYNCHRONOUS SATELLITE Ph.D. Thesis
Ernest Patrick Hanavan, Jr. 1972 93 p
Avail: Univ. Microfilms Order No. 72-25778

The effects of the perturbations of the sun, the moon and the asphericity of the earth's gravity field on a low eccentricity low inclination synchronous satellite are determined. The equations of perturbed motion are derived in rectilinear form with the Mean Equator and Equinox of 1950.0 as the Newtonian reference frame. Precession and nutation are included. The 1969 Smithsonian Standard Earth (II) is the model for the geopotential. The gradient of the geopotential is derived and expressed in terms of explicit functions of satellite position. These functions are enumerated in an appendix. Spherical harmonics through tenth order are included. The method of variation of parameters is used to determine the effects of the perturbations by step-by-step numerical integration using the Gaussian second sum integration formulae. Dissert. Abstr.

N73-22768*# National Aeronautics and Space Administration, Washington, D.C.
VIKING LANDING SITES News Release
Nick Panagakos 7 May 1973 14 p
(NASA-News-Release-73-91) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Maryland 20780 CSCL 22A

A valley near the mouth of the 20,000-foot-deep Martian Grand Canyon has been chosen by NASA as the site of its first automated landing on the planet Mars. The landing site for the second mission of the 1975-76 Viking spacecraft will probably be an area about 1,000 miles northeast of the first site, where the likelihood of water increases the chances of finding evidence of life. Author

N73-22769*# Texas Univ., Dallas.
SCANNING ELECTRON MICROSCOPY, NON-DISPERSIVE X-RAY ANALYSIS AND ELECTRON MICROPROBE STUDIES OF LUNAR SOIL, ROCKS AND MICROBRECCIA Progress Report
J. L. Carter 28 Sep. 1972 31 p refs
(Grant NGR-44-004-116)
(NASA-CR-131870) Avail: NTIS HC $3.75 CSCL 03B

Silicate glass of composition similar to brown lunar glass was reduced with carbon and hydrogen. The typical complex iron sulfide and metallic iron mound formed by reduction with carbon is zoned. Its interior is metallic iron or a mixture of iron sulfide and metallic iron. The outer layer is pure metallic iron which is generally discontinuous, but the surface of the mound next to the silicate host is iron sulfide. This type of mound commonly has a waist of metallic iron and a void beneath it. The silicate surface of the void is covered with droplets or stringers of iron sulfide. The complex iron sulfide and metallic iron mounds formed by reduction with hydrogen generally are zoned. The outer layer is iron sulfide or a mixture of iron sulfide and metallic iron but the interior is metallic iron and iron sulfide, and the mound material next to the silicate host is iron sulfide. On the surface of some complex mounds, globules of silicate material are present. In one example, the globules consist of particles of aluminum oxide surrounded by silicate material. In turn, the margin of the globules is surrounded by iron sulfide. Dimples are present and surface of the dimples is covered by dendritic sheaths of iron sulfide and isolated metallic iron globules. Author

N73-22770*# Bendix Corp., Denver, Colo.
ASTRONOMY SORTIE MISSION DEFINITION STUDY. ADDENDUM: FOLLOW-ON ANALYSES Final Report
Mar. 1973 280 p refs Addendum to 4-vol. Final Report dated Sep. 1972 Prepared in cooperation with Itek Corp., Lexington, Mass. and Martin Marietta Corp., Denver
(Contract NAS8-28144)
(NASA-CR-131892; AM-1002-1005-add) Avail: NTIS HC $16.00 CSCL 03A

Results of design analyses, trade studies, and planning data of the Astronomy Sortie Mission Definition Study are presented. An in-depth analysis of UV instruments, nondeployed solar payload, and on-orbit access is presented. Planning data are considered, including the cost and schedules associated with the astronomy instruments and/or support hardware. Costs are presented in a parametric fashion. J.A.M.

N73-22771*# Texas Univ., Austin.
LUNAR LASER RANGING DATA DEPOSITED IN THE NATIONAL SPACE SCIENCE DATA CENTER: FILTERED OBSERVATIONS FOR JANUARY - JUNE 1971 AND UNFILTERED PHOTON DETECTIONS FOR JULY - DECEMBER 1971
J. Derral Mulholland and Peter J. Shelus Jan. 1973 6 p refs
(Grant NGR-44-012-219)
(NASA-CR-131498; Rept-73-013) Avail: NTIS HC $3.00 CSCL 03A

The filtered data are discussed which were obtained during laser ranging operations with Apollo reflectors placed on the moon at Tranquility Base, Fra Mauro, and Hadley. Unfiltered photon detections are described. F.O.S.

N73-22772*# IIT Research Inst., Chicago, Ill. Physics Research Div.
GROUND BASED PLANETARY RESEARCH Final Report, 26 Apr. 1972 - 4 Apr. 1973
4 Apr. 1973 61 p refs
(Contract NASw-2363; IITRI Proj. V6127)
(NASA-CR-131891) Avail: NTIS HC $5.25 CSCL 03B

High spatial resolution spectrophotometric observations made in the wavelength region lambda lambda 0.6 - 2.0 micrometers are used to study the Jovian and Saturnian limb darkening. Limb darkening coefficients (k) of the Minnaert function are derived for the cloud layers of both planets. A value of k = 1.0 is found for Jupiter over the entire disk while values of between 0.75 and 0.90 are found for different latitudes for Saturn. These data are used to derive geometric albedoes (G) for the various belts, zones, spots and regions observed on Jupiter and Saturn. These values of G and k are in turn used to show that an isotropic scattering model is invalid for Jupiter and that at least an asymmetric scattering function, such as the Euler function, is needed to fit the Jovian data. The Jovian scattering function is found to generally vary between 0.960 and 0.994 as a function of wavelength and the feature observed. The Saturn geometric albedoes and values of k indicate that Euler's function fails to adequately model the scattering properties of the Saturnian clouds. As a result it is suggested that simple scattering theory may not apply to the Saturn clouds or that they are better represented by a cumulus cloud model. Author

N73-22773# European Southern Observatory, Santiago (Chile).
[RESEARCH PROGRESS ON 3.6 m TELESCOPE PROJECT AND AUXILIARY EQUIPMENT] Annual Report, 1971
1971 72 p refs Original contains color illustrations
Avail: NTIS HC $5.75

The research activities of ESO are reported. Subjects discussed include: galactic structure, Magellanic Clouds, external galaxies, the 3.6 m telescope project, and the Schmidt telescope project. A financial statement is included. F.O.S.

N73-22774# Instituto Geografico y Catastral, Madrid (Spain).
ANNUAL FOR THE ASTRONOMICAL-OBSERVATORY OF MADRID FOR 1973 [ANUARIO DEL OBSERVATORIO ASTRONOMICO DE MADRID PARA 1973]
1972 500 p refs In SPANISH
Avail: NTIS HC $27.00

The astronomical catalog for 1973 is presented. A calendar indicating significant events is presented along with the ephemer-

ides of the sun, moon, and planets. Sky charts for each month, time conversion equations, and a discussion of galaxies are included. Transl. by F.O.S.

N73-22775*# California Univ., Berkeley. Space Sciences Lab.
THE MEAN PHOTOSPHERIC MAGNETIC FIELD FROM SOLAR MAGNETOGRAMS: COMPARISONS WITH THE INTERPLANETARY MAGNETIC FIELD
Philip H. Scherrer, John M. Wilcox, and Robert Howard (Calif. Inst. of Tech., Pasadena) 4 Aug. 1971 17 p refs
(Grant NGL-05-003-230; Contracts N00014-69-A-0200-1049; N00014-66-C-0239; Grant NSF GA-16765)
(NASA-CR-131607; AD-728792; SSL-Ser-12-Issue-56) Avail: NTIS HC $3.00 CSCL 03/2

Large-scale averages of daily solar magnetograms have been compared by cross-correlation with the interplanetary magnetic sector pattern during a 2 1/2 year interval. A significant correlation was found at a lag of about 4 1/2 days, with the amplitude of the correlation depending on the area included in the magnetograms averages. The highest correlation was found when an area of one quarter of the solar disk was used, which is consistent with the idea that the photospheric features which are to be associated with the interplanetary sector pattern are large-scale features. Author (GRA)

N73-22776# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE NO. 299
30 Apr. 1973 78 p refs Transl. into ENGLISH from Russian reports
(JPRS-58885) Avail: NTIS HC $6.00

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of space spectaculars are included. Author

N73-22777*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOLOGIC EVOLUTION OF THE MOON
Paul D. Lowman, Jr. Oct. 1971 67 p refs Revised Submitted for publication
(NASA-TM-X-65939; X-644-71-483) Avail: NTIS HC $5.50 CSCL 03B

A synthesis of pre- and post-Apollo 11 studies is presented to produce an outline of the moon's geologic evolution from three lines of evidence: (1) relative ages of lunar landforms and rock types, (2) absolute ages of returned lunar samples, and (3) petrography, chemistry, and isotopic ratios of lunar rocks and soils. It is assumed that the ray craters, circular mare basins, and most intermediate circular landforms are primarily of impact origin, although many other landforms are volcanic or of hybrid origin. The moon's evolution is divided into four main stages, each including several distinct but overlapping events or processes. Author

N73-22778*# McDonnell-Douglas Corp., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY, VOLUME 1, SECTIONS 1 - 6
[1971] 793 p refs 8 Vol.
(Contract NAS1-9464)
(NASA-CR-112325) Avail: NTIS HC $41.75 CSCL 22A

A reference manual for planners of manned earth-orbital research activity is presented. The manual serves as a systems approach to experiment and mission planning based on an integrated consideration of candidate research programs and the appropriate vehicle, mission, and technology development requirements. Long range goals and objectives for NASA activities during the 1970 to 1980 time period are analyzed. The useful and proper roles of manned and automated spacecraft for implementing NASA experiments are described. An integrated consideration of NASA long range goals and objectives, the system and mission requirements, and the alternative implementation plans are developed. Specific areas of investigation are: (1) manned space flight requirements, (2) space biology, (3) spaceborne astronomy, (4) space communications and navigation, (5) earth observation, (6) supporting technology development requirements, (7) data management system matrices, (8) instrumentation matrices, and (9) biotechnology laboratory experiments. Author

N73-22779*# McDonnell-Douglas Corp., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY. VOLUME 2: MANNED SPACEFLIGHT CAPABILITY (APPENDICES A, B, C)
[1971] 593 p refs 8 Vol.
(Contract NAS1-9464)
(NASA-CR-112326) Avail: NTIS HC $31.75 CSCL 22A
For abstract, see N73-22778.

N73-22780*# McDonnell-Douglas Corp., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY. VOLUME 3: SPACE BIOLOGY (APPENDICES A, B, C)
[1971] 213 p 8 Vol.
(Contract NAS1-9464)
(NASA-CR-112327) Avail: NTIS HC $12.75 CSCL 22A
For abstract, see N73-22778.

N73-22781*# McDonnell-Douglas Corp., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY. VOLUME 4: SPACE ASTRONOMY (APPENDICES A, B, C, D) AND SPACE PHYSICS (APPENDICES A, B, C)
[1971] 380 p refs
(Contract NAS1-9464)
(NASA-CR-112328) Avail: NTIS HC $21.00 CSCL 22A
For abstract, see N73-22778.

N73-22782*# McDonnell-Douglas Corp., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY. VOLUME 5: COMMUNICATIONS AND NAVIGATION (APPENDICES A, B, C)
[1971] 204 p refs
(Contract NAS1-9464)
(NASA-CR-112329) Avail: NTIS HC $12.25 CSCL 22A
For abstract, see N73-22778.

N73-22783*# McDonnell-Douglas Corp., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY. VOLUME 6: EARTH OBSERVATIONS (APPENDICES A, B, C)
[1971] 380 p refs
(Contract NAS1-9464)
(NASA-CR-112330) Avail: NTIS HC $21.00 CSCL 22A
For abstract, see N73-22778.

N73-22784*# McDonnell-Douglas Corp., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY. VOLUME 7: SUPPORTING TECHNOLOGY DEVELOPMENT REQUIREMENT DESCRIPTIONS (APPENDIX E)
[1971] 519 p refs
(Contract NAS1-9464)
(NASA-CR-112331) Avail: NTIS HC $28.00 CSCL 22A
For abstract, see N73-22778.

N73-22785*# McDonnell-Douglas Corp., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY. VOLUME 8. APPENDIX F: DATA MANAGEMENT SYSTEMS MATRICES. APPENDIX G: INSTRUMENTATION MATRICES AND CONCEPTUAL CONFIGURATION DRAWINGS. APPENDIX H: RELATED BIOTECHNOLOGY LABORATORY EXPERIMENTS
[1971] 278 p
(Contract NAS1-9464)
(NASA-CR-112332) Avail: NTIS HC $16.00 CSCL 22A
For abstract, see N73-22778.

N73-22786*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY ANALYSIS OF THE GEMINI ENTRY AERODYNAMICS
Arthur Miles Whitnah and David B. Howes Nov. 1972 51 p (NASA-TM-X-58100; MSC-07467) Avail: NTIS HC$4.75 CSCL 22C

The aerodynamic data that were derived in 1967 from the analysis of flight-generated data for the Gemini entry module are presented. These data represent the aerodynamic characteristics exhibited by the vehicle during the entry portion of Gemini 2, 3, 5, 8, 10, 11, and 12 missions. For the Gemini, 5, 8, 10, 11, and 12 missions, the flight-generated lift-to-drag ratios and corresponding angles of attack are compared with the wind tunnel data. These comparisons show that the flight generated lift-to-drag ratios are consistently lower than were anticipated from the tunnel data. Numerous data uncertainties are cited that provide an insight into the problems that are related to an analysis of flight data developed from instrumentation systems, the primary functions of which are other than the evaluation of flight aerodynamic performance. Author

N73-22787# Royal Greenwich Observatory, Herstmonceux (England).
UBV OBSERVATIONS OF THE RR LYRAE VARIABLE HD 176387 (MT TELESCOPII)
J. B. Alexander 1 Jan. 1972 12 p refs
(Roy-Obs-Bull-174) Avail: NTIS HC $3.00; Roy. Greenwich Obs., Herstmonceux £0.20

Some UBV observations of the RR Lyrae variable HD 176387 made with the 40-inch reflector at the Cape Observatory during 1970 are described. The significance of the anti-clockwise loop performed by the star in the (U-B, B-V) plane as shown by photometric examination is discussed. ESRO

N73-22788# Royal Greenwich Observatory, Herstmonceux (England).
THE MASS-LUMINOSITY RELATIONSHIP OF THE HYADES AND OTHER STARS
J. B. Alexander Dec. 1971 10 p refs
(Roy-Obs-Bull-175) Avail: NTIS HC $3.00; Roy. Greenwich Obs., Herstmonceux £0.20

The mass-luminosity relationship of the Hyades cluster is rediscussed and the conclusions of a previous paper are confirmed. Although the mass-luminosity relationship of the cluster is poorly determined at present, it is probable that the unevolved stars in the Hyades are somewhat undermassive when compared with typical unevolved field stars of the corresponding luminosity. For stars in the general field, there is no evidence for two discrete mass-luminosity relationships. Author (ESRO)

N73-22789# Royal Greenwich Observatory, Herstmonceux (England).
UBV PHOTOELECTRIC OBSERVATIONS
Elizabeth A. Epps Jun. 1972 22 p refs
(Roy-Obs-Bull-176) Avail: NTIS HC $3.25; Roy. Greenwich Obs., Herstmonceux £0.40

Observations, made by UBV photometry, are presented for 115 nearby stars (within 25 pc of the sun), for bright secondary standards in ten quasar fields and ten galaxy fields, and for stars in eleven Kapteyn selected areas. In addition, UBV data are given for several miscellaneous stars including R CrB, delta Cep C, six M supergiants, five red giants in M67, and four horizontal branch stars. Author (ESRO)

N73-22790# Royal Aircraft Establishment, Farnborough (England).
A RUNGE-KUTTA PROCESS FOR STARTING NEAR-CIRCULAR ORBIT INTEGRATIONS
R. H. Merson Aug. 1972 34 p refs
(RAE-TR-72118; BR-31123) Avail: NTIS HC $3.75

In order to use the eighth order Gauss-Jackson second sum method for integrating second order differential equations it is necessary to provide the first eight points by some other means. It is common practice to use the classical fourth order by Runge-Kutta process for this purpose. By a suitable choice of parameters for a fourth order process it is shown that a nearly three-fold improvement in starting efficiency can be obtained. Author (ESRO)

N73-22791# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.
GREENWICH TIME REPORT Quarterly Report, Jan. - Mar. 1972
1972 20 p
Avail: NTIS HC $3.00

Results of Greenwich time and latitude observations for the period January to March 1972 are presented. Also included are radio time signals and standard frequency emissions. ESRO

N73-22792*# Stanford Univ., Calif. Inst. for Plasma Research.
SCIENTIFIC EXPLORATION WITH AN OUT-OF-ECLIPTIC SPACECRAFT
John M. Wilcox Feb. 1973 24 p refs Submitted for publication
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138; NR Proj. 323-003)
(NASA-CR-131865; AD-757081; SU-IPR-504) Avail: NTIS HC $3.25 CSCL 22/2

The scientific objectives for an out-of-ecliptic spacecraft mission are reviewed. Much has been learned that was new and unexpected by observing the equatorial regions of the solar wind. It may be anticipated that equally surprising and new understanding will result from an out-of-ecliptic mission. Possible areas of research which will benefit from such a mission include: solar wind, solar magnetic field, solar corona, galactic cosmic rays. Author (GRA)

N73-22793# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PRELIMINARY ORBIT DETERMINATION OF ARTIFICIAL EARTH SATELLITES FROM A SMALL NUMBER OF ANGLE-ONLY OBSERVATIONS
Barry W. Bryant and Donna M. Edwards 9 Jan. 1973 39 p refs
(Contract F19628-73-C-0002; ARPA Order 600)
(AD-755399; TN-1973-5; ESD-TR-73-53) Avail: NTIS CSCL 22/3

The problem of determining the preliminary orbital elements of a previously unobserved earth satellite from a minimum number of angle-only observations has been investigated. The Planetary Ephemeris Program (PEP) was used to generate exact ephemerides (of selected orbits) which were then used as input to an angle-only tracking algorithm derived from the method of Gauss. This algorithm yields the approximate orbital elements under the assumption of Keplerian motion. Comparison of these elements with the ones assumed in PEP has indicated that the Keplerian approximation improves considerably as the unknown satellite altitude is increased from 1/4 to 3 times synchronous, and that such a tracking algorithm would be useful in many practical situations where one is constrained to a few angle-only observations. Estimates are given of the accuracy needed in the input data to insure reasonable success in this method of preliminary orbit determination. Author (GRA)

N73-22794# California Univ., Los Angeles. School of Engineering and Applied Science.
INTERCEPTING AN ACCELERATING TARGET USING QUASI-OPTIMAL CONTROL
Henry Flader Eide Sep. 1972 50 p refs
(Contract F04701-72-C-0273; Grant AF-AFOSR-2166-72; AF Proj. 9769)
(AD-755795; UCLA-ENG-7274; AFOSR-73-0225TR) Avail: NTIS CSCL 16/2

The technique of quasi-optimum control, developed by B. Friedland is applied to the problem of intercepting an accelerating target with an air-launched missile. The problem is first stated as an optimal control problem with nonlinear system equations and a quadratic cost functional. Several techniques of finding feedback type optimal controls which have been developed by solving various approximations to the original problem are then described. None of these techniques makes explicit use of a measurement of lateral target acceleration. Three control techniques are then developed which use measurements of target acceleration to develop closed form controls. The first control is found by solving a linearized version of the original problem. The other two controls are quasi-optimum controls

which use the solution of the linearized problem to obtain a new feedback type solution that is more nearly optimal for the original problem. Based on performance in simulations of typical attack geometries and target maneuvers, these three control techniques are found to be superior to previous techniques.
Author (GRA)

N73-22795*# California Univ., Berkeley. Space Sciences Lab.
SOLAR MAGNETIC FIELDS: EXTENDED
John M. Wilcox 29 Jun. 1971 33 p refs Presented at the Symp. on Magnetic Field in Stars, Wailu, Hawaii, Jun. 1971 Submitted for publication
(Grant NGL-05-003-230; Contract N00014-69-A-0200-1049; Grant NSF GA-16765)
(NASA-CR-131832; AD-727985) Avail: NTIS HC 43.75 CSCL 03/2

Spacecraft observations of the interplanetary magnetic field have revealed that almost always each solar rotation can be divided into sectors, within each of which the field has a predominant polarity toward the sun or away from the sun. Comparisons of this interplanetary magnetic sector pattern with observations of the photospheric magnetic field have revealed a similar solar magnetic pattern. The boundaries between solar magnetic sectors are approximately in the north-south direction over a wide range of latitudes on both sides of the equator. This solar magnetic sector structure can be described as a rotating dipole whose magnetic axis makes an angle of approximately 90 deg with the axis of rotation. Possible similarities between this solar sector magnetism and the models derived from observations of stellar magnetism are discussed. Author

N73-22796*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A 2 cm RADIOMETER DATA CATALOG, 29 JUNE 1967 - 10 MARCH 1970 Progress Report, 1971
Stanley D. Shawhan, Gerald F. Denning, and Davis D. Sentman Oct. 1971 36 p refs
(Grant NGL-16-001-002; Contract 014-68-A-0196-0003)
(NASA-CR-131830; AD-744952; U-of-Iowa-71-50) Avail: NTIS HC $4.00 CSCL 03/2

A 2-cm radiometer (15,375 MHz) has been operated by the University of Iowa Department of Physics and Astronomy between 27 June 1967 and March 1970 at the North Liberty Radio Observatory. The system operation and calibration procedure and the data storage and retrieval methods are briefly described. References are given to more complete descriptions. A data catalog is presented which lists the date, universal start and end times, quality of data records, data record type, and an indication of activity level observable on each data record.
Author (GRA)

N73-22797*# California Univ., Berkeley. Space Sciences Lab.
A STUDY OF THE FIVE MINUTE OSCILLATIONS, SUPERGRANULATION, AND RELATED PHENOMENA IN THE SOLAR ATMOSPHERE
Andrew S. Tanenbaum 20 May 1971 146 p refs
(Grant NGL-05-003-230; Contract N00014-69-A-0200-1049; Grant NSF GA-16765; NR Proj. 021-109)
(NASA-CR-131606; AD-725870; SSL-Ser-12-Issue-38) Avail: NTIS HC $9.50 CSCL 03/2

In the early 1960's two new types of motion in the sun's atmosphere were discovered; the 5-minute oscillations and the supergranulation. The 5-minute oscillations consist of a predominantly vertical hydrodynamic wave motion in the photosphere and chromosphere with amplitudes around 500 meters/sec. The supergranulation consists of a series of convective cells, 30,000 km in diameter, in which material rises at the center, flows horizontally outward, and falls at the boundaries. The horizontal motion in the supergranulation was clearly observed, but its vertical motion was observed only marginally at best. The observations that form the basis of this thesis were made at the Mt. Wilson Observatory 150-foot solar telescope. The observing equipment is described in detail, including the optics, guiding and scanning system, spectrograph, magnetograph, electronics, and data system. The observing procedure used in these observations is carefully described, as is the method of calibrating the Doppler, Zeeman, and intensity signals. The initial data reduction is also discussed. Various measurements of the size and lifetime of the 5-minute oscillations are reported.
Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N73-22798 Cornell Univ., Ithaca, N.Y.
A SYSTEMS ANALYSIS APPROACH TO LANDING GEAR DESIGN Ph.D. Thesis
Peter James Rojeski, Jr. 1972 197 p
Avail: Univ. Microfilms Order No. 72-27971

A systematic, mathematically oriented method for approximating locally optimal lunar landing gear design parameter values for a front-foot touchdown mode is presented. The design method, which combines a digital simulation of the landing vehicle with a steepest descent algorithm, results in several locally optimal solutions. The steepest descent algorithm, used in the search for the local optima, requires derivatives which must be approximated because the relationships between the design variables and the state variables are not explicit, but are in the form of a digital simulation. Alternative feasible solutions are compared on the basis of total gear weight and vehicle stability. A quantitative definition of stability allows for the definition of a stability safety factor, which is desirable because it is practical to compute the feasibility of a design for all anticipated landing conditions. The design approach is applicable, in general, to systems whose solution surface is generated by the numerical solutions of the state equations describing the system.
Dissert. Abstr.

N73-22799*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 1: SUMMARY. PART 2: FINAL REPORT, 22 AUGUST 1972 - 1 APRIL 1973
1 Apr. 1973 80 p
(Contract NAS5-21704)
(NASA-CR-130219) Avail: NTIS HC $6.00 CSCL 22B

A Tracking and Data Relay Satellite System (TDRSS) concept for service of low, medium, and high data rate user spacecraft has been defined. During the study, four TDRS dual spin stabilized configurations (contractual requirement) were designed; two are compatible with Delta 2914, one with Atlas Centaur, and one with space shuttle launches. A summary of the study and the salient results are presented. The topics included are: (1) TDRSS operations, (2) telecommunications service performance, telecommunications service equipment, (3) TDRS configurations and their design characteristics, and (4) TDRS system reliability. Author

N73-22800*# Hughes Aircraft Co., El Segundo, Calif. Space Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 2: DELTA 2914 LAUNCHED TDRSS, CONFIGURATION 2. PART 2: FINAL REPORT, 22 AUGUST 1972 - 1 APRIL 1973
1 Apr. 1973 305 p
(Contract NAS5-21704)
(NASA-CR-130220) Avail: NTIS HC $17.25 CSCL 22B

Configuration data and design information for a Delta 2914 launched configuration with greatly enhanced telecommunication service over the Part I Delta 2914 configuration is contained. The overall system definition, operations and control, and telecommunication service system, including link budgets, are discussed. A brief description of the user transceiver and ground station is presented. A final section includes a summary description of the TDR spacecraft and all the subsystems. The data presented are largely in tabular form. Author

N73-22801*# Hughes Aircraft Co., El Segundo, Calif. Space Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 3: ATLAS CENTAUR LAUNCHED TDRSS. PART 2: FINAL REPORT, 22 AUGUST 1972 - 1 APRIL 1973
1 Apr. 1973 247 p
(Contract NAS5-21704)
(NASA-CR-130221) Avail: NTIS HC $14.50 CSCL 22B

Configuration data and design information for the Atlas Centaur launched configuration are presented. Overall system definition, operations and control, and telecommunication service system, including link budgets, are discussed. A brief description of the user telecommunications equipment and ground station is presented. A summary description of the TDR spacecraft and all the subsystems is included. The data presented are largely in tabular form. A brief treatment of an optional configuration with enhanced telecommunications service is described. Author

N73-22802*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 4: SPACE SHUTTLE LAUNCHED TDRSS. PART 2: FINAL REPORT, 22 AUGUST 1972 - 1 APRIL 1973
1 Apr. 1973 195 p
(Contract NAS5-21704)
(NASA-CR-130222) Avail: NTIS HC $11.75 CSCL 22B

Configuration data and design information for the space shuttle launched configuration is presented. The overall system definition, operations and control, and telecommunication service system including link budgets are discussed. A brief description of the user transceiver and ground station is presented. A final section includes a summary description of the TDR spacecraft and all the subsystems. The data presented are largely in tabular form. Author

N73-22803*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 USER'S GUIDE
Romeo R. Sabatini, ed. (Allied Research Associates, Inc., Concord, Mass.) Mar. 1970 229 p refs Prepared by Allied Research Associates, Inc., Concord, Mass.
(Contract NAS5-10343; Proj. Nimbus)
(NASA-TM-X-69887) Avail: NTIS HC $13.50 CSCL 22C

Background information on the Nimbus 4 spacecraft and experiments is provided for potential data users as a basis for selecting, obtaining, and utilizing Nimbus 4 data in research studies. The basic spacecraft system operation and the objectives of the Nimbus 4 flight are outlined, with a detailed discussion of each of the experiments included. The format, archiving, and access to the data are also described. Finally, the contents and format of the Nimbus 4 data catalogs are described. Author

N73-22804*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 DATA CATALOG. VOLUME 1: DATA ORBITS 131-600, 18 APRIL - 22 MAY 1970
Aug. 1970 274 p Prepared by Allied Research Associates, Inc., Concord, Mass.
(Contract NAS5-10343; Proj. Nimbus)
(NASA-TM-X-69888) Avail: NTIS HC $15.75 CSCL 22C

A catalog is presented of data acquired from the Nimbus 4 Meteorological Satellite and includes: the type of data available; anomalies in the data, if any; the geographic location; and the time of data. In addition, some preliminary results are given from various Nimbus 4 experiments. Author

N73-22805*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 DATA CATALOG. VOLUME 2: DATA ORBITS 601-1123, 23 MAY - 30 JUNE 1970
Oct. 1970 270 p Prepared by Allied Research Associates, Inc., Concord, Mass.
(Contract NAS5-10343; Proj. Nimbus)
(NASA-TM-X-69889) Avail: NTIS HC $15.50 CSCL 22C

Documentation of data acquired from the Nimbus 4 Meteorological Satellite for the period from 23 May to 30 June 1970 is provided. Included are the types of data available, anomalies in the data, geographic location, and time notations. Author

N73-22806*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 DATA CATALOG. VOLUME 3: DATA ORBITS 1124-1956, 1 JULY - 31 AUGUST 1970
Mar. 1971 400 p Prepared by Allied Research Associates, Inc., Concord, Mass.
(Contract NAS5-10343; Proj. Nimbus)
(NASA-TM-X-69890) Avail: NTIS HC $22.00 CSCL 22C

The Nimbus 4 satellite catalog for the period of 1 July through 31 August 1970 is presented. The subjects discussed are: (1) summary of operations, (2) orbital elements and daily sensors on table, (3) image dissector camera system montages, and (4) temperature-humidity infrared radiometer montages. Data are presented as tables and photographs. Author

N73-22807*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 DATA CATALOG. VOLUME 4: DATA ORBITS 1957-2775 AND INTERROGATION, RECORDING AND LOCATION SYSTEM (IRLS) BALLOON TRACKING EXPERIMENT DATA FROM LAUNCH THROUGH 27 MARCH 1971, 1 SEPTEMBER - 31 OCTOBER 1970
May 1971 396 p Prepared by Allied Research Associates, Inc., Concord, Mass.
(Contract NAS5-21617; Proj. Nimbus)
(NASA-TM-X-69891) Avail: NTIS HC $22.00 CSCL 22C

Nimbus 4 satellite data for the period September 1 through October 31, 1970, are presented. Data are also given on interrogation recording and location system balloon tracking from launch through March 27, 1971. E.H.W.

N73-22808*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 DATA CATALOG. VOLUME 5: DATA ORBITS 2776-3594, 1 NOVEMBER - 31 DECEMBER 1970
Jun. 1971 339 p Prepared by Allied Research Associates, Inc., Concord, Mass.
(Contract NAS5-21617; Proj. Nimbus)
(NASA-TM-X-69892) Avail: NTIS HC $19.00 CSCL 22C

A catalog of Nimbus 4 satellite observations for the period 1 November through 31 December 1970 is presented. The data include the following: (1) summary of operations, (2) orbital elements and daily sensors on table, (3) image dissector camera study montages, and (4) temperature-humidity infrared radiometer montages. Data are presented in tables and photographs. Author

N73-22809*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 DATA CATALOG. VOLUME 6: DATA ORBITS 3595-4386, 1 JANUARY - 28 FEBRUARY 1971
Aug. 1971 281 p Prepared by Allied Research Associates, Inc., Concord, Mass.
(Contract NAS5-21617; Proj. Nimbus)
(NASA-TM-X-69893) Avail: NTIS HC $16.25 CSCL 22C

Documentation of data acquired from the Nimbus 4 Meteorological Satellite for the period from 1 January to 28 February 1971 is provided. Included are the types of data available, anomalies in the data, geographic location, and time notations. Author

N73-22810*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 DATA CATALOG. VOLUME 7: DATA ORBITS 4387-5205, 1 MARCH - 30 APRIL 1971
May 1972 238 p Prepared by Allied Research Associates, Inc., Baltimore
(Contract NAS5-21617; Proj. Nimbus)
(NASA-TM-X-69894) Avail: NTIS HC $14.00 CSCL 22C

Data acquired by Nimbus 4 satellite for the period March 1 to April 30, 1971, are documented. Data are cataloged for orbits 4387 through 5205 and for operational highlights of individual experiments. E.H.W.

N73-22811*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 DATA CATALOG. VOLUME 8: DATA ORBITS 5206-10,120, 1 MAY 1971 - 30 APRIL 1972
Aug. 1972 224 p Prepared by Allied Research Associates, Inc., Baltimore
(Contract NAS5-21617; Proj. Nimbus)
(NASA-TM-X-69895) Avail: NTIS HC $13.25 CSCL 22C

Data from various instruments onboard the Nimbus 4 are presented, including the image dissector camera system, the temperature-humidity infrared radiometer, infrared interferometer spectrometer, and monitor of ultraviolet solar energy experiments. This data was collected from 1 May 1971 to 30 April 1972. Orbital elements and daily sensor data are presented in tabular form. J.A.M.

N73-22812*# Radiation, Inc., Melbourne, Fla. Systems Engineering Dept.
DCS: A GLOBAL SATELLITE ENVIRONMENTAL DATA COLLECTION SYSTEM STUDY Final Report
Jan. 1973 214 p
(Contract NAS5-21622)
(NASA-CR-130232) Avail: NTIS HC $2.75 CSCL 22A

Cost analysis and technical feasibility data are presented on five medium orbiting and six geosynchronous satellite data collection systems with varying degrees of spacecraft and local user terminal complexity. Data are also provided on system approaches, user requirements, and user classes. Systems considered include orbiting ERTS and EOS type satellites and geosynchronous SmS and SEOS type data collectors. E.H.W.

N73-22813*# Auburn Univ., Ala. Dept. of Mathematics.
FURTHER COMMENTS ON THE APPLICATION OF THE METHOD OF AVERAGING TO THE STUDY OF THE ROTATIONAL MOTIONS OF A TRIAXIAL RIGID BODY, PART 3 Final Report, 1 Apr. - 30 Sep. 1972
J. J. F. Liu and Philip M. Fitzpatrick 31 Mar. 1973 43 p refs
(Grant NGR-01-003-036)
(NASA-CR-131871) Avail: NTIS HC $4.25 CSCL 22A

Variational equations were applied to the case of a rapidly spinning triaxial body moving in an elliptic orbit, in which the orbital plane is regressing at a constant rate. The explicit differential equations obtained in this application were integrated by the method of averaging to develop secular analytical expressions, which, to first-order in a small parameter, describe the complete space motions of the rigid body under the influence of nonresonant gravity-gradient perturbations. The effects of aerodynamic torque on the rotational motion of an orbiting satellite are studied as another example of the application of the variational equations derived and the method of averaging. Author

N73-22814*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CALIBRATION OF PROPULSION SIMULATION NOZZLES FOR SPACE SHUTTLE BOOSTER AND ORBITER MODELS FOR THE ABORT/SEPARATION STAGING EXPERIMENTAL PROGRAM
L. Ray Baker, Jr. Jul. 1971 34 p refs
(Contract NAS8-20082)
(NASA-CR-124217; TM-54/20-320; LMSC/HREC-D225144) Avail: NTIS HC $3.75 CSCL 22B

An experimental program to determine the power-on aerodynamic flight characteristics of the booster and orbiter vehicles during the abort separation maneuver is reported. An essential contribution to such a test program is the gas dynamic simulation of the size and shape of the plumes emitting from the full-scale orbiter and booster main propulsion systems. The two major effects of the plume which must be simulated are: the interaction of the plume with the external flow field, and the direct impingement of the plumes on surfaces which are enveloped by the plume. To accomplish the objective of correct plume simulation, the similarity parameters developed by Herron and the requirement to match momentum flux per unit area between the model and the full-scale systems were applied to the orbiter and booster propulsion systems. Author

N73-22815*# Systems Research Lab., Champaign, Ill.
RESEARCH STUDY ON STABILIZATION AND CONTROL: MODERN SAMPLED DATA CONTROL THEORY Final Report
B. C. Kuo, G. Singh, and R. A. Yackel Apr. 1973 251 p refs
(Contract NAS8-28584)
(NASA-CR-124223) Avail: NTIS HC $14.75 CSCL 22B

A numerical analysis of spacecraft stability parameters was conducted. The analysis is based on a digital approximation by point by point state comparison. The technique used is that of approximating a continuous data system by a sampled data model by comparison of the states of the two systems. Application of the method to the digital redesign of the simplified one axis dynamics of the Skylab is presented. Author

N73-22816*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
A MODULE FOR AUTOMATIC DOCK AND DETUMBLE (MADD) FOR ORBITAL RESCUE OPERATIONS
William R. Snow, Bohdan G. Kunciw, and Marshall H. Kaplan Apr. 1973 64 p refs
(Grant NGR-39-009-210)
(NASA-CR-131592; RR-73-3) Avail: NTIS HC $5.25 CSCL 22C

The module for automatic dock and detumble (MADD) is an automated device for bringing a passive, tumbling space base under control in an orbital rescue situation. The conceptual design of such a device resulted from a consideration of tumbling motion analyses and mission constraints. Specific topics of investigation include orbit and attitude dynamics and detumble profiles. Position and attitude control systems for the various phases of operation were developed. Dynamic motion of a passive vehicle with MADD attached is considered as an example application and to determine control requirements. Since time is a critical factor in rescue operations, it is essential to execute the detumbling maneuver in a minimum of time. Optimization of the MADD thrusting sequence has also been investigated. Results indicate the control torque must be directed opposite to the angular momentum vector for the assumption used here. Author

N73-22817*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
ERTS 1 LAUNCH AND FLIGHT ACTIVATION EVALUATION REPORT, 23 - 26 JULY 1972. LAUNCH THROUGH ORBIT 35 AND ORBIT ADJUST OPERATION
18 Oct. 1972 272 p
(Contract NAS5-11320)
(NASA-CR-130150; Doc-72SD4255) Avail: NTIS HC $15.75 CSCL 22C

The results of the analysis conducted on the telemetry data from the prelaunch, launch, and flight activation phases of the ERTS-1 spacecraft are presented. It is presented by subsystem sections and provides for inter-relationships as they exist between the several subsystems. A brief statement of subsystem characteristics precedes flight evaluation statements. The appendix contains a total list of components flow on ERTS-1 and a complete listing of commands and telemetry functions for reference. Author

N73-22818*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
ERTS 1 FLIGHT EVALUATION REPORT, 23 OCTOBER 1972 - 23 JANUARY 1973
27 Feb. 1973 192 p refs
(Contract NAS5-21808)
(NASA-CR-130207; Doc-73SD4224; Rept-3) Avail: NTIS HC $11.75 CSCL 22C

Analyses of ERTS-1 performance for the second three months of operation, orbits 1300 to 2600, are presented. Author

N73-22819*# Computer Sciences Corp., Falls Church, Va.
STUDY OF REPEATER TECHNOLOGY FOR ADVANCED MULTIFUNCTIONAL COMMUNICATIONS SATELLITES Phase 1 and 2 Combined Final Report
Nov. 1972 318 p refs
(Contract NAS5-21695)
(NASA-CR-130210) Avail: NTIS HC $18.00 CSCL 17B

Investigations are presented concerning design concepts and implementation approaches for the satellite communication

repeater subsystems of advanced multifunctional satellites. In such systems the important concepts are the use of multiple antenna beams, repeater switching (routing), and efficient spectrum utilization through frequency reuse. An information base on these techniques was developed and tradeoff analyses were made of repeater design concepts, with the work design taken in a broad sense to include modulation beam coverage patterns. There were five major areas of study: requirements analysis and processing; study of interbeam interference in multibeam systems; characterization of multiple-beam switching repeaters; estimation of repeater weight and power for a number of alternatives; and tradeoff analyses based on these weight and power data.
Author

N73-22820*# North American Rockwell Corp., Downey, Calif. Space Div.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 1: STUDY SUMMARY Final Report
Tom E. Hill Apr. 1973 170 p
(Contract NAS5-21705)
(NASA-CR-130216; SD-73-SA-0018-1-Vol-1) Avail: NTIS HC $10.50 CSCL 22B

A study was conducted to determine the configuration and tradeoffs of a tracking and data relay satellite. The study emphasized the design of a three axis stabilized satellite and a telecommunications system optimized for support of low and medium data rate user spacecraft. Telecommunications support to low and high, or low medium, and high data rate users, considering launches with the Delta 2914, the Atlas/Centaur, and the space shuttle was also considered. The following subjects are presented: (1) launch and deployment profile, (2) spacecraft mechanical and structural design, (3) attitude stabilization and control subsystem, and (4) reliability analysis. Author

N73-22821*# North American Rockwell Corp., Downey, Calif. Space Div.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 2: PART 2 TELECOMMUNICATIONS DESIGN Final Report
Tom E. Hill Apr. 1973 251 p refs
(Contract NAS5-21705)
(NASA-CR-130217; SD-73-SA-0018-2-Vol-2) Avail: NTIS HC $14.75 CSCL 22B

For abstract, see N73-22820.

N73-22822*# North American Rockwell Corp., Downey, Calif. Space Div.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 3: PART 2 SPACECRAFT DESIGN Final Report
Tom E. Hill Apr. 1973 132 p
(Contract NAS5-21705)
(NASA-CR-130218; SD-73-SA-0018-3-Vol-3) Avail: NTIS HC $8.75 CSCL 22B

For abstract, see N73-22820.

N73-22823*# Analytical Research Labs., Inc., Monrovia, Calif.
COLLECTION AND MEASUREMENT OF ATMOSPHERIC CONTAMINANTS DURING SKYLAB AM/MDA UNMANNED ALTITUDE CHAMBER TEST Final Report
Dec. 1972 46 p
(Contract NAS9-11960)
(NASA-CR-128903; Rept-3003-F-1) Avail: NTIS HC $4.50 CSCL 22B

The analytical data obtained from both cryogenic and grab sampling of the atmosphere of the Skylab AM/MDA during an 84 hour unmanned chamber run are reported. The level of contaminants found at different points of the test chamber are tabulated. The results indicate that there was no clear trend of increasing or decreasing contaminant levels during the test run.
F.O.S.

N73-22824# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, DECEMBER 1972
R. D. Eberst 12 Jan. 1973 34 p
(ROE-STS-138) Avail: NTIS HC $3.75

Stopwatch observations made at stations during December 1972 are listed in lauch and time order for each satellite. Various subtotals are given. Author (ESRO)

N73-22825# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
HEWITT CAMERA OBSERVATIONS MADE AT EARLYPOINT ON VARIOUS SATELLITES FROM 1 OCTOBER 1972 TO 31 DECEMBER 1972
K. S. Russell 19 Jan. 1973 38 p ref
(ROE-STS-139) Avail: NTIS HC $4.00

Satellite observations made with a Hewitt camera at Earlyburn Outstation are listed in launch and time order for each satellite from 1 Oct. 1972 to 31 Dec. 1972. Author (ESRO)

N73-22826# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
SORTIE-LABORATORY PRELIMINARY DEFINITION STUDY. REQUIREMENTS AND CONCEPTS REPORT
15 Nov. 1972 707 p
(Contract ESTEC-1644/72-EL; MBB Proj. 6.606.1)
(MBB-SL-72-04; ESRO-CR(P)-238) Avail: NTIS HC $37.50

Conceptual approaches for a Sortie Lab are defined, meeting US and European requirements of candidate payloads optimized by computerized benefit/worth analyses. The various subsystems are examined in detail. These include structural design, thermal, attitude and environmental control, electrical power, communications and data management, and ground support equipment. The evaluation of concepts resulted in a common support system for an integrated payload system providing flexibility, standardization and reduced turnaround time. ESRO

N73-22827# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY DEFINITION STUDY OF A SORTIE MODULE/PALLET SYSTEM. FINAL CONCEPT REVIEW, VOLUME 1 Final Report
[1972] 120 p 2 Vol.
(ESRO-CR(P)-239) Avail: NTIS HC $8.00

The overall objective of this study is to provide preliminary data concerning a sortie module/pallet system which would be used in an assessment of possible European participation in the post-Apollo Program. The system requirements, concept and analysis are first defined, and then the various subsystems examined in detail. These include the structural subsystem for the sortie module, the pallet structure and configuration, thermal control subsystem, electrical power system, attitude control system, communications and data management subsystem, interface and shuttle/orbiter, cost estimates, and computer programs. ESRO

N73-22828# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY DEFINITION STUDY OF A SORTIE MODULE/PALLET SYSTEM. FINAL CONCEPT REVIEW, VOLUME 2 Final Report
[1972] 478 p
(ESRO-CR(P)-240) Avail: NTIS HC $26.00

The overall objective of this study is to provide preliminary data concerning a sortie module/pallet system which would be used in an assessment of possible European participation in the post-Apollo program. The system requirements, concept and analysis are first defined, and then various subsystems examined in detail. These include the structural subsystem for the sortie module, the pallet structure and configuration, the thermal control subsystem, electrical power, attitude control system, communications and data management subsystem, interface with shuttle/orbiter, cost estimates and computer programs. ESRO

N73-22829# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
CINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE PERIOD FROM 15 FEBRUARY TO 18 FEBRUARY 1966
K. S. Russell 20 Feb. 1973 44 p ref
(ROE-STS-142) Avail: NTIS HC $4.25

Timed observations of satellites, made in azimuth and

elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order for each satellite. Author (ESRO)

N73-22830# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
CINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE PERIOD FROM 19 FEBRUARY TO 1 MARCH 1966
K. S. Russell 27 Feb. 1973 44 p ref
(ROE-STS-143) Avail: NTIS HC $4.25

Timed observations of satellites, made in azimuth and elevation with cinetheodolite at Earlyburn, are listed in launch and time order for each satellite. Author (ESRO)

N73-22831# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
GEOSYNCHRONOUS SPACE TUG MISSIONS
J. W. Cornelisse and K. F. Wakker Aug. 1972 132 p refs
(VTH-171) Avail: NTIS HC $8.75

Pertinent data on the space shuttle and a selected space tug concept are given. Placement, retrieval, and roundtrip flights are considered for a geosynchronous mission with an orbital inclination of 28.5 deg, as well as for the geostationary mission. For both missions different strategies are discussed, and payload capabilities are calculated as a function of the tug initial mass for all strategies. The best strategy for each mission is determined. Author (ESRO)

N73-22832# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF AN UPPER STAGE ROCKET PLANE WITH EXTERNAL BURNING THRUST AUGMENTATION Final Report
E. E. Callens, J. T. Miller, and J. L. Potter AEDC Feb. 1973 72 p refs Sponsored by AEDC
(AD-756498; ARO-VKF-TR-72-94; AEDC-TR-72-181) Avail: NTIS CSCL 22/2

Some fundamental aspects of a regeneratively cooled, upper stage rocket plane with external-burning thrust augmentation are investigated analytically. Cases considered are only the ejected coolant is burned externally and all of the thrust required for sustained cruise is provided by external burning. One conclusion is that external-burning configurations offer an apparent advantage over internal propulsion systems in that the total vehicle cooling requirement for high-speed operation is much less for the external-burning regeneratively cooled configuration. Also, the fuel required for propulsion by an external-burning configuration greatly exceeds the fuel required for cooling. Author (GRA)

N73-22833# Autonetics, Anaheim, Calif.
SOFTWARE VALIDATION STUDY Final Report, Jul. - Dec. 1972
D. Bruce Brosius Feb. 1973 235 p refs
(Contract F04701-72-C-0370)
(AD-757212; C73-11/201; SAMSO-TR-73-99) Avail: NTIS CSCL 16/4

The Software Validation Study was undertaken to provide an understanding and assessment of the process used to develop the software for a current ballistic missile system, the Minuteman III system, particularly the process of identifying software requirements and performing software testing. This information is intended to provide the foundation for development of advanced techniques to be applied to future software developments.
Author (GRA)

N73-22834*# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
HEAT-TRANSFER AND FLOW-FIELD TESTS OF THE NORTH AMERICAN ROCKWELL/GENERAL DYNAMICS CONVAIR SPACE SHUTTLE CONFIGURATIONS Final Report, Jun. - Sep. 1971
W. R. Martindale (ARO, Inc.), R. K. Matthews (ARO, Inc.), and L. L. Trimmer (ARO, Inc.) Jan. 1973 96 p refs Sponsored in part by NASA
(NASA-CR-131486; AD-755354; AEDC-TR-72-169; ARO-VKF-TR-72-123) Avail: NTIS HC $7.00 CSCL 22/2

Aerothermodynamic tests of Phase B space shuttle configurations proposed by North American Rockwell/General Dynamics Convair were conducted at Mach number 8. Test conditions provided both Mach number and Reynolds number simulation for typical ascent and reentry trajectories. This report provides a comprehensive analysis of the major test results and also presents data comparisons with theoretical calculations. Specific areas covered are: ascent heating and shock interference, booster reentry heating and flow fields, and orbiter reentry including leeside heating, windward shock angles and flow fields, windward surface heating, and boundary-layer transition. Author (GRA)

N73-22835# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENESIS OF MODERN ROCKET DYNAMICS
A. P. Mandryka 17 Nov. 1972 305 p refs Transl. into ENGLISH of the publ "Genezis Sovremennoi Raketodinamiki" Leningrad, Nauka, 1971 p 1-215
(AD-756962; FTD-MT-24-600-72) Avail: NTIS CSCL 19/4

Given in this book is a detailed analysis of the development of rocket dynamics from middle of the nineteenth century to 1960, inclusively. The formulation of rocket dynamics from the development of the dynamics of a particle of variable mass, aerodynamically and, most importantly, the formulation of external ballistics are shown. Considerable attention is devoted to the application of numerical methods to ballistics on the basis of manual calculating technology and electronic computers and the use of these methods in rocket dynamics. The main attention is directed to the evolution of methods for determining the trajectory of the center of the mass of a rocket. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-22836 British Steel Corp., London (England). Metallurgy Dept.
A TECHNIQUE FOR MONITORING CRACK EXTENSION DURING COD MEASUREMENT
P. McIntyre and D. Elliott [1972] 19 p refs
(MG/15/72) Copyright. Avail: Issuing Activity

A dc electrical resistance crack monitoring technique was developed to enable the detection of the crack extension processes which occur during the measurement of crack opening displacement (COD) in steels. The approach is able to distinguish between stretch zone formation, which occurs early in the loading process, and fibrous extension which follows it. Results are presented for two strength carbon-manganese steels in which the crack extension which accompanies COD measurement over a range of temperatures was monitored by the electrical resistance technique, and confirmed by subsequent fractographic examination. Author

N73-22837 Ohio State Univ., Columbus.
VIBRATION ANALYSIS OF CURVED SKIN STRINGER STRUCTURES HAVING TUNED ELASTOMERIC DAMPERS Ph.D. Thesis
John Phillips Henderson 1972 144 p
Avail: Univ. Microfilms Order No. 72-27022

The steady state vibration response of curved skin-stringer structure is analyzed through the application of transfer matrix techniques. The effects of stringer stretching and finite stringer width are analyzed. Specifically, the analysis is demonstrated on a structure consisting of a row of five cylindrically curved panels, with constant radius of curvature, stiffened by stringers parallel to the generators and simply supported by frames normal to the stringers at the edges. The effect of tuned elastomeric dampers, each consisting of a mass on an elastomeric spring, attached at various locations on the panels is investigated. It is shown that a single tuned damper weighing only 3 percent the weight of the skin, in the center of each panel, can effectively damp at least five of the lower frequency vibration modes. Formulation of the analysis is suitable for numerical analysis of a digital computer, and several examples of numerical results are presented. Dissert. Abstr.

N73-22838 Wisconsin Univ., Madison.
SHELL THEORY AND THREE DIMENSIONAL ANALYSIS OF CYLINDRICAL SHELLS SUBJECTED TO AXISYMMETRIC TANGENTIAL SURFACE LOADS Ph.D. Thesis
Pen-Chu Hu 1972 131 p
Avail: Univ. Microfilms Order No. 72-22096

The development of a linear shell theory in which the transverse shear deformation and normal stress effects are taken into account is presented. The problem of an infinite cylindrical shell subjected to uniform, periodic, axisymmetric tangential loads is considered and solved by using the classical Flugge's theory, the proposed higher order shell theory, and the three-dimensional theory of linear elasticity. Attention is restricted here to axially symmetric deformation for the sake of brevity but the method of approach may be generalized to other cases and geometric configurations. The displacement and stress distributions throughout the shell are represented in graphics, where a comparison in accuracy can be made among the exact solutions of elasticity and those obtained by two shell theories. Discrepancies between the results predicted by Flugge's theory and the proposed shell theory, which stem mainly from the effect of transverse shear deformation, do exist as shown in these graphics. Numerical results for stress and displacement fields are carried out for various values of thickness radius ratio ranging from 0.1 to 0.001. Dissert. Abstr.

N73-22839 Lehigh Univ., Bethlehem, Pa.
CRACK PROPAGATION INDUCED BY DYNAMIC LOADING Ph.D. Thesis
Tony Er-Ping Chen 1972 140 p
Avail: Univ. Microfilms Order No. 72-25866

The dissertation is concerned with the diffraction of elastic stress waves by a moving crack. The crack configuration can be either semi-infinite or finite in length. The problem is formulated in a set of moving coordinates and is reduced to the solution of systems of dual integral equations. For the semi-infinite crack, an exact solution is obtained by using a method based on the Wiener-Hopf technique. Using an integral transform method, the systems of dual integral equations of the finite crack problem are reduced to the Fredholm equations of the second kind. As in the static cases, the near-field dynamic stresses possess the familiar inverse square-root singularity at the crack tip. The stress-intensity factors, however, are found to depend on the incident wave-length, angle of incidence, Poisson's ratio of the elastic solid and speed of crack propagation. The stress-intensity factor serves as a useful parameter in studying elastodynamic crack problems since it can be associated with the rate at which elastic and kinetic energies are released by the crack.
Dissert. Abstr.

N73-22840 Georgia Inst. of Tech., Atlanta.
ON THE BUCKLING AND VIBRATION BEHAVIOR OF A THIN TENSIONED SHEET WITH AN ELLIPTICAL HOLE Ph.D. Thesis
Prosun Kumar Datta 1972 144 p
Avail: Univ. Microfilms Order No. 72-26305

The results of an experimental and analytical study of the buckling and vibration behavior of tensioned sheets with an elliptical opening are presented. Data from buckling and vibration experiments for several opening shapes ranging between a crack and a circle are presented. A generalized Galerkin method of solving the governing differential equations is used and the results obtained are presented in terms of buckling loads and natural frequencies. The experimental buckling stress estimates correlate well with the analytical results. The data from the vibration experiments indicate that the load vs. frequency behavior is dependent on the size of the test specimen and the opening shape. The analytical results display a load vs. frequency behavior which is experimentally observed for a narrow elliptical hole; i.e., for a small value of the ratio of minor axis to major axis.
Dissert. Abstr.

N73-22841 Wisconsin Univ., Madison.
FRACTURE OF A CRACKED SOLID CIRCULAR CYLINDER Ph.D. Thesis
Richard Ned Johnson 1972 192 p
Avail: Univ. Microfilms Order No. 72-22099

A theoretical investigation was made of various types of cracks in the radial plane (the plane normal to the cylinder axis) of a solid right circular cylinder. The analysis used was a numerical three-dimensional stress analysis employing a set of simultaneous singular integral equations developed by Somigliano and Rizzo based on the classical Betti's Identities in elasticity. The solutions are entirely linear elastic and based on a numerical approximation to surface integrals. The Rizzo formulation of the equations renders an essentially three-dimensional volume problem a two-dimensional surface problem, thus reducing it to a tractable level. The derivation of the basic equations is presented in detail.
Dissert. Abstr.

N73-22842 Pennsylvania Univ., Philadelphia.
HIGHER ORDER THEORIES AND SOLUTION TECHNIQUE FOR MODERATELY THICK SHELLS OF REVOLUTION Ph.D. Thesis
Guy James Hutchins 1972 188 p
Avail: Univ. Microfilms Order No. 72-25591

A general method for obtaining higher order theories for analysis of elastic shell type structures is presented. Attention is focused primarily on shells of revolution under axisymmetric loadings. Reissner's Principle, together with Legendre Polynomial series expansions are key features of the development. Using a postulated truncation scheme to obtain a finite dimensioned theory, results are obtained that are quite acceptable when compared with an exact solution of the 3-D elasticity equations. Maximum thickness to radius ratios and elastic moduli ratios are presented which determine the range of applicability of the postulated theory. A computer program was developed for solution of a shell type problem incorporating higher order St. Venant decay effects. This program is amenable to quick application without the need for special computer knowledge.
Dissert. Abstr.

N73-22843 California Univ., Los Angeles.
STRESS DISTRIBUTION IN AN ADHESIVE JOINT Ph.D. Thesis
Dick Jei Chang 1972 100 p
Avail: Univ. Microfilms Order No. 72-25761

Stress distribution in lap joints under cleavage and tension-shear loading is considered in terms of the classical two-dimensional theory of elasticity. The thickness of the adhesive layer is assumed to be zero in the analysis. The cleavage problem is reduced to a Fredholm integral equation of the second kind, and the tension-shear problem reduces to a pair of equations of the same sort. Numerical results are presented for the distributions of bond forces and for stress intensity factors at the edge of the bond, covering all technically significant combinations of the material and geometrical parameters. Dissert. Abstr.

N73-22844 West Virginia Univ., Morgantown.
NONLINEAR AXISYMMETRIC DEFORMATION OF ORTHOTROPIC SHELLS OF REVOLUTION Ph.D. Thesis
Ping Wah Chan 1972 160 p
Avail: Univ. Microfilms Order No. 72-26860

The solution is considered of Reissner's axisymmetric finite deformation equations for an arbitrary shallow orthotropic shell of revolution which is subjected to uniform pressure and edge loadings; and Reissner's theory is extended to the consideration of the orthotropic circular cylindrical shell equations. Multiple scale solutions of these equations are developed and evaluated. Newton's method of variation in combination with a numerical technique is used to determine the analytical effect of approximations on the solutions obtained by the multiple scale method.
Dissert. Abstr.

N73-22845 Houston Univ., Tex.
THE EFFECT OF TRANSVERSE SHEAR DEFORMATION ON THE LARGE-AMPLITUDE FREE VIBRATIONS OF PLATES AND CYLINDRICAL PANELS Ph.D. Thesis
Chao-Hwang Su 1972 110 p
Avail: Univ. Microfilms Order No. 72-27520

The equations of nonlinear flexural vibrations of plates and cylindrical panels are derived with the effects of rotatory inertia and transverse shear deformation taken into account. The Galerkin technique is used to solve the nonlinear differential equations. The one-term approximate solutions of the free vibrations of a rectangular plate and cylindrical panel is found. With the

assumption that the in-plane inertia and rotatory inertia effects are negligible, it is found that the transverse shear deformation has greater influence on the free vibrations of transversely isotropic plates with large E/Gc ratio (such as pyrolytic graphite material) than on isotropic plates. The same is true for a cylindrical panel. Dissert. Abstr.

N73-22846 Lehigh Univ., Bethlehem, Pa.
STUDIES OF THE CRACK OPENING STRETCH CONCEPT IN APPLICATION TO SEVERAL FRACTURE PROBLEMS Ph.D. Thesis
Hiroshi Tada 1972 254 p
Avail: Univ. Microfilms Order No. 72-25898

The usefulness of crack opening stretch concept, as a simple available plasticity characterization parameter of crack tip strain field, was studied. It was found that a direct proportionality is nearly maintained up to stress levels large enough for net section for the case of relatively small cracks. An approximate analysis of an I beam with a three-ended crack subjected to a cyclic bending is presented. The flange and web are treated as two separate plane problems. The interaction between cracks is obtained from the equality of the openings of the flange and web cracks. Dissert. Abstr.

N73-22847 University of Southern Calif., Los Angeles.
BUCKLING OF STIFFENED CYLINDRICAL SHELLS SUBJECTED TO COMBINED AXIAL COMPRESSION, NORMAL PRESSURE, BENDING AND SHEAR LOADING Ph.D. Thesis
Robert Richard Meyer 1972 221 p
Avail: Univ. Microfilms Order No. 72-25810

When a stiffened circular cylinder is loaded by a system of increasing combined axial compression, normal pressure, end moment and lateral shear, a point in the loading path will be reached at which the deformation response suddenly changes in character. To obtain theoretical buckling loads for stiffened cylinders under the given conditions, constitutive equations, describing the linear between stress resultants, couples and strains and changes of curvature are first developed. Explicit forms are derived for 0 deg - 90 deg, 45 deg and 60 deg isogrid stiffening patterns. These, together with the strain-displacement relations and the equations of equilibrium form the governing equations of the problem. A complete set of solution functions which satisfy homogeneous boundary conditions for the condition of simple support are substituted into the governing equations. Conditions for these equations to satisfy the differential equations are provided by means of the method of Galerkin. Dissert. Abstr.

N73-22848*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
A CRACK PROBLEM WITH FOUR DISTINCT HARMONIC FUNCTIONS
George C. Sih and Mumtaz K. Kassir (City Univ. of New York, N. Y.) May 1972 26 p refs
(Grant NGR-39-007-066)
(NASA-CR-112317; NASA-TR-72-2; IFSM-72-18) Avail: NTIS HC $3.50 CSCL 20K

The problem of an elastic solid containing a semi-infinite plane crack subjected to concentrated shears parallel to the edge of the crack is considered. A closed form solution using four distinct harmonic functions (none of which can be taken arbitrarily) is found to satisfy the finite displacement and inverse square root stress singularity at the edge of the crack. Explicit expressions in terms of elementary functions are given for the distribution of stress and displacement in the solid. These are obtained by employing Fourier and Kontorovich-Lebedev integral transforms and certain singular solutions of Laplace equations in three dimensions. The variations of the intensity of the local stress field along the crack border are shown graphically. An example is presented, which is in contrast with the conclusion established in the literature that one of the four Papkovich-Neuber functions in three-dimensional elasticity may be arbitrarily set to zero. Author

N73-22849*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
THE PROBLEM OF A FINITE STRIP COMPRESSED BETWEEN TWO ROUGH RIGID STAMPS
G. D. Gupta Jan. 1973 26 p refs
(Grant NGR-39-007-011)
(NASA-CR-112318; NASA-TR-73-1; IFSM-73-27) Avail: NTIS HC $3.50 CSCL 20K

A finite strip compressed between two rough rigid stamps is considered. The elastostatic problem is formulated in terms of a singular integral equation from which the proper stress singularities at the corners are determined. The singular integral equation is solved numerically to determine the stresses along the fixed ends of the strip. The effect of material properties and strip geometry on the stress intensity factor is presented graphically. Author

N73-22850*# National Aeronautics and Space Administration, Washington, D.C.
RESEARCH AND TECHNOLOGY ADVISORY COMMITTEE ON MATERIALS AND STRUCTURES: REPORT OF MEETING, FEBRUARY 1973
Feb. 1973 15 p Meeting held at Hampton, Va., 6-7 Feb. 1973
(NASA-TM-X-69227) Avail: NTIS HC $3.00 CSCL 20K

The proceedings of a conference on Materials and Structures is presented. The subjects discussed are: (1) basic materials research, (2) fracture control, (3) aerospace vehicle dynamics and control, and (4) tramp elements in fuels and alloys. Author

N73-22851*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
METHODS FOR STRUCTURAL DESIGN AT ELEVATED TEMPERATURES Final Report
A. M. Ellison, W. E. Jones, Jr., and K. R. Leimbach Apr. 1973 189 p refs
(Contract NAS8-28170)
(NASA-CR-124232; HREC-8170-1; LMSC/HREC-TR-D306579) Avail: NTIS HC $11.50 CSCL 13M

A procedure which can be used to design elevated temperature structures is discussed. The desired goal is to have the same confidence in the structural integrity at elevated temperature as the factor of safety gives on mechanical loads at room temperature. Methods of design and analysis for creep, creep rupture, and creep buckling are presented. Example problems are included to illustrate the analytical methods. Creep data for some common structural materials are presented. Appendix B is description, user's manual, and listing for the creep analysis program. The program predicts time to a given creep or to creep rupture for a material subjected to a specified stress-temperature-time spectrum. Fatigue at elevated temperature is discussed. Methods of analysis for high stress - low cycle fatigue, fatigue below the creep range, and fatigue in the creep range are included. The interaction of thermal fatigue and mechanical loads is considered, and a detailed approach to fatigue analysis is given for structures operating below the creep range. Author

N73-22852# Defence Standards Labs., Maribyrnong (Australia).
FORCE-DEFLECTION MEASUREMENT IN THE CHARPY IMPACT TEST
K. A. M. Eberhardt Sep. 1972 18 p refs
(Rept-527) Avail: NTIS HC $3.00

A 300J (220 ft lb) Charpy impact testing machine was instrumented to measure and record the force applied by the striker and the deflection of the test piece under that force. Although force was measured by the usual method of strain gauges on the striker, the dynamic deflection of the test piece during fracture was measured using capacitance, one capacitor plate being attached to the striker and the other plate fixed to the machine base. The force and deflection signals were displayed on an oscilloscope and the test trace photographed. To enable tough and brittle specimens to produce easily measured force/deflection diagrams the deflection sensitivity was made variable to give between 2.5 mm/cm and 0.5 mm/cm on the oscilloscope. Comparison of the energy indicated by the machine and that deduced from the photographic record gave agreement to within 3%. Author

N73-22853*# Vought Aeronautics, Dallas, Tex.
FATIGUE EVALUATION OF COMPOSITE-REINFORCED, INTEGRALLY STIFFENED METAL PANELS
C. E. Dumesnil [1973] 387 p refs
(Contract NAS1-10871)

(NASA-CR-112148) Avail: NTIS HC $21.50 CSCL 20K

The fatigue behavior of composite-reinforced, integrally stiffened metal panels was investigated in combined metal and composite materials subjected to fatigue loading. The systems investigated were aluminum-graphite/epoxy, and aluminum-S glass/epoxy. It was found that the composite material would support the total load at limit stress after the metal had completely failed, and the weight of the composite-metal system would be equal to that of an all metal system which would carry the same total load at limit stress. F.O.S.

N73-22854# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

WAVES IN SOLID MEDIA AND LOADS ON STRUCTURES

G. M. Lakhov and N. I. Polyakova 10 Mar. 1972 342 p refs Transl. into ENGLISH from Volny v Plotnykh Sredakh i Nagruzki na Sooruzheniya (USSR), 1967 p 1-232

(AD-742421; FTD-MT-24-1137-71; Rept-73-00819) Avail: NTIS HC $19.25 CSCL 20K

The propagation of shock and continuous waves in solid plastic media, wave refraction of media interfaces, and also interaction with the elements of structures are discussed. The problem of considering viscous properties of media when solving certain wave problems is considered. The results are applied also to waves in rods. Specific attention is given to the presentation of laboratory findings on the dynamic properties of soils and on the regularities of the propagation of pressure waves in soils. Information from the general theory of shock waves, which is necessary for understanding the basic materials, is presented. Author

N73-22855*# Martin Marietta Corp., Denver, Colo.

FATIGUE FLAW GROWTH BEHAVIOR IN STIFFENED AND UNSTIFFENED PANELS LOADED IN BIAXIAL TENSION

E. J. Beck Feb. 1973 166 p refs

(Contract NAS9-12439)

(NASA-CR-128904; MCR-73-61) Avail: NTIS HC $10.50 CSCL 20K

The effect was investigated of biaxial loading on the flaw growth rate of 2219-T87 aluminum alloy that would be typical of Space Shuttle cryogenic tankage design. The stress distribution and stress concentration factors for several integrally stiffened panels under various loading conditions were obtained. The flaw growth behavior of both stiffened and unstiffened panels under biaxial loading conditions was determined. The effect of a complex stress state was studied by introducing flaws in fillet areas of biaxially loaded stiffened panels. Author

N73-22856# Rolls-Royce, Ltd., Bristol (England).

INVESTIGATION OF FIBERS AND COMPOSITES APPLICABLE TO THE DESIGN OF HIGH PRESSURE VESSELS FOR SATELLITES

A. E. Davey and R. D. Curnow Aug. 1972 297 p refs

(Contract ESTEC-1486/71-AA)

(RRCM/ED/R/10; ESRO-CR(P)-160) Avail: NTIS HC $17.00

A study has been made of the application of fibers and composite materials to the construction of a low mass, long life, high pressure gas storage vessel for satellite altitude control systems. The operational requirements demand good dynamic fatigue and long term sustained pressure loading resistance, combined with compatibility with a wide range of media stored with negligible leakage. The results are presented in four parts, consisting of a literature survey, a parametric theoretical investigation, leading on to a proposed vessel design and proposals for future work. Author (ESRO)

N73-22857# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.

THE ESTABLISHMENT OF REQUIREMENTS AND RECOMMENDATIONS FOR SPACECRAFT STRUCTURES Final Report

30 Nov. 1972 129 p

(Contract ESTEC-1535/71-HP; MBB Proj. 6.608.7)

(ESRO-CR(P)-200) Avail: NTIS HC $8.50

The establishment of procedures for the compilation of a guide to spacecraft structural design requirements is presented. An organization and management scheme to generate the ultimate guide document is described and a method of data collection and analysis is outlined. A program plan describing the flow of work is given and various cost breakdowns are included. A preliminary specification for the guide is given in an appendix. ESRO

N73-22858# Hawker Siddeley Dynamics, Ltd., Hatfield (England). Space Div.

REPORT ON A STUDY OF THE COMPILATION OF AN ESRO STRUCTURES AND MECHANISMS DESIGN REQUIREMENT DOCUMENT FOR SPACECRAFT

J. K. Bennett, comp. Dec. 1972 61 p

(Contract ESTEC-1536/71-HP)

(HSD-TP-7363; ESRO-CR(P)-224) Avail: NTIS HC $5.25

The compilation of guidelines for the requirements of spacecraft structural design is discussed and the methods used for a preliminary study detailed. Contents and chapter headings of the guide are proposed and the grouping and inter-relation of subjects discussed. Possible methods of compilation are given, together with costs and time scales. A recommended solution is considered. ESRO

N73-22859# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany). Advanced Technology Div.

INVESTIGATION OF FIBERS AND COMPOSITES APPLICABLE TO THE DESIGN OF HIGH PRESSURE VESSELS FOR SATELLITES

30 Sep. 1972 177 p refs Partly in ENGLISH and partly in GERMAN

(Contract ESTEC-1485/71-AA)

(MAN-NT-10/72; ESRO-CR(P)-229) Avail: NTIS HC $11.00

The present state of development in the field of composite materials is reviewed with special regard to the construction of vessels for high-pressure gases. A theoretical efficiency comparison between metals and composites is discussed and the work carried out to develop such vessels described. ESRO

N73-22860# Southampton Univ. (England). Inst. of Sound and Vibration Research.

STRAINS AFFECTING THE GROWTH RATE OF EDGE CRACKS IN ACOUSTICALLY EXCITED PANELS

K. P. Byrne Nov. 1972 74 p refs Sponsored by Min. of Defence

(ISVR-TR-59) Avail: NTIS HC $5.75

A method is described for estimating the magnitude of the bending strains which cause cracks to propagate along the edges of aircraft skin panels due to their out-of-plane vibration. The excitation of the panels is assumed to be due to a convected random pressure field. Theoretical estimates of the bending strains are compared with experimental results obtained using a high intensity random noise facility. Author (ESRO)

N73-22861# Oxford Univ. (England). Dept. of Engineering Science.

MICHELL FRAMEWORK FOR UNIFORM LOAD BETWEEN FIXED SUPPORTS

W. S. Hemp Feb. 1973 17 p refs

(Rept-1054/73) Avail: NTIS HC $3.00

A proposed half-plane Michell framework for uniform load between fixed supports is analyzed. It is shown that it is the best structure among a general class of layouts, which only excludes some non-vertical members in a restricted region near the bottom of the half-plane adjacent to the center line. ESRO

N73-22862# National Aerospace Lab., Amsterdam (Netherlands).

THE EFFECT OF SECONDARY BENDING ON THE FATIGUE STRENGTH OF (CLAD 2024-T3 AND 7075-T6) ALUMINUM ALLOY RIVETED JOINTS

A. Hartman Dec. 1971 17 p refs

(NLR-TR-72007-U) Avail: NTIS HC $3.00

Comparative program fatigue tests on three types of light alloy riveted strap joints confirmed the relation between the bending factor of the joint and the program fatigue life. The bending factor is defined as the ratio between sum of calculated nominal tensile and bending stresses at the critical section and the nominal tensile stress. In a semi-log plot the relation can be approximated by a straight line with a slope of -1.5. The fatigue life of the 2024-T3 Al clad specimens was about three

to four times longer than that of identical 7075-T6 clad specimens. Author (ESRO)

N73-22863# Technische Hogeschool, Delft (Netherlands).
THE SENSITIVITY OF THIN-WALLED COMPRESSION MEMBERS TO COLUMN AXIS IMPERFECTION
A. VanderNeut Aug. 1972 22 p refs
(VTH-172) Avail: NTIS HC $3.25

The imperfection sensitivity of thin-walled compression members to the initial waviness of the composing walls and to the imperfection of the column axis was analyzed in a previous report, though not adequately. Here the correction is given and the reduction of the failure load due to this kind of imperfection in the case of an idealized column is evaluated and discussed. ESRO

N73-22864# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
DETERMINATION OF STRESS INTENSITY FACTORS FROM PHOTOELASTIC DATA WITH APPLICATIONS TO SURFACE FLAW PROBLEMS
M. A. Schroedl, J. J. McGowan, and C. W. Smith Jan. 1973 41 p refs
(Contract DAAF07-69-C-0444)
(AD-756872; VPI-E-73-1) Avail: NTIS CSCL 20/11

A Taylor series correction to the maximum in plane shear stress was studied as a means of extending the data zone in photoelastic determination of stress intensity factors beyond the singular region of a two degree of freedom analysis. Convergence properties were obtained by comparing with several complete two-dimensional solutions. Experiments were performed on two kinds of three-dimensional problems; plates containing surface flaws in both bending and extension. Results were analyzed by both a two degree of freedom and a Taylor series correction method. Author (GRA)

N73-22865# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
UNIQUENESS FOR PLANE CRACK PROBLEMS IN LINEAR ELASTOSTATICS
James K. Knowles and T. A. Pucik Dec. 1972 15 p refs
(Contract N00014-67-A-0094-0020; NR Proj. 064-31)
(AD-756653; TR-26) Avail: NTIS CSCL 20/11

The paper contains a proof of the uniqueness of solution to the traction boundary value problem in linear elastostatics for a bounded domain containing a crack. Attention is restricted to the two-dimensional case, but the elastic material considered need not be homogeneous or isotropic. In addition to the hypotheses assumed in the standard uniqueness theorem of Kirchhoff, it is required that the displacement field be bounded near the crack tips. Author (GRA)

N73-22866# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
A DIGITAL COMPUTER STUDY OF THE BUCKLING OF ACTUAL IMPERFECT CYCLINDERS. A MODIFICATION OF THE COMPUTER PROGRAM SATANS. THEORY AND USER'S MANUAL FOR SATANS-1 AND SATANS-2
Bruce Anthony Ryan Dec. 1972 268 p refs
(AD-756545) Avail: NTIS CSCL 20/11

A digital computer program for the geometrically nonlinear static and dynamic response of arbitrarily loaded shells of revolution known as SATANS is modified, removing a requirement that the applied loads be symmetric about a datum meridional plane. The ability to include arbitrary naturally occurring initial geometric imperfections of any shape, location or extent is added to the program. Two specific axially loaded circular cylinders are analyzed using actual initial imperfections. Detailed numerical studies are conducted to determine the buckling loads of the perfect and imperfect cylinders. Several sets of boundary conditions are considered. An analysis procedure for imperfect shells is proposed. The results indicate that a means to conduct a numerical analysis of an arbitrarily imperfect shell of revolution has been developed. A study of the buckling behavior of the clamped shallow spherical cap modelled under various boundary conditions at the pole is included as an addendum. SATANS-I and SATANS-II were written in FORTRAN for IBM 360/67 computers with OS/MVT. The report includes source program listings. Author (GRA)

N73-22867# Watervliet Arsenal, N.Y.
EXTENTIONAL VIBRATIONS OF SIMPLY SUPPORTED COMPOSITE PLATE STRIPS
Charles R. Thomas Dec. 1972 47 p refs
(DA Proj. 1F0-61102-A-35D)
(AD-756868; WVT-7263) Avail: NTIS CSCL 20/11

The recently derived effective stiffness, velocity corrected Sun plate equation for extensional vibrations are reduced for the case of a plate strip and frequency equations are derived for simply supported edges by the method of M. Levy, where solutions harmonic in plate width are assumed and the boundary conditions for simple supports are automatically satisfied. The results are compared to extensional frequencies for a reduced effective modulus velocity corrected Sun plate theory and for both a velocity corrected and shear corrected Mindlin plate theory with Postma elastic constants introduced. Author (GRA)

N73-22868# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF IMPACT EFFECTS ON STRUCTURES
I Rabinovich, M. and A. P. Sinitsyn 8 Dec. 1972 495 p refs Transl. into ENGLISH of the publ. "Sooruzhenii na Impulsivnye Vozdeistviya" Moscow, 1970 p 1-304
(AF Proj. 1368)
(AD-756959) Avail: NTIS CSCL 13/13

The book examines the dynamic calculation of various types of structural components which are used in various structural designs: beams, arches, frames, trusses, panels, thin rods, folding systems, and shells. Discussed are modern methods of determining natural frequencies and the vibration shapes which correspond to them. Basic ideas on the dynamic calculation of systems with finite and infinite numbers of degrees of freedom are given. In this work attention is focused on analyzing the effect of short-term impulse loads in structural design. The book contains appropriate reference materials. Author(GRA)

N73-22869# Naval Postgraduate School, Monterey, Calif.
CHARACTERIZATION OF ELASTIC SOLIDS USING FINITE ELEMENT METHODS M.S. Thesis
Brian Alfred Edwards Dec. 1972 94 p refs
(AD-756513) Avail: NTIS CSCL 20/12

Finite element methods are applied to the problem of characterizing linear, anisotropic elastic solids. The conventional finite element displacement formulation is used to simulate an elastic material in plane stress. An inverted finite element formulation is then applied, and the characterizing six material constants are calculated as numerical results. A possible test device for the experimental characterization of anisotropic solids is postulated, the precision of displacement measurements to be required for such a device being determined by random perturbation analysis. Numerical constants accurate to within three percent are predicted if a precision of one part in eight hundred (1/800) can be measured. Numerical constants accurate to within one percent are predicted if a precision of one part in eight thousand (1/8000) can be measured in the test device. Author (GRA)

N73-22870# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LARGE DEFLECTIONS OF PLATES WITH NONLINEAR ELASTICITY AND HOLLOW SHELLS WITH HINGE-SUPPORTED EDGES
M. S. Kornishin, N. N. Stolyarov, and N. I. Dedov 26 Jan. 1973 17 p refs Transl. into ENGLISH from Tr. Seminara po Teorii Obolochek (Kazan), no. 2, 1971 p 49-58
(AD-756103; FTD-HT-23-1814-72) Avail: NTIS CSCL 20/11

The method of finite differences was used to solve problems dealing with large deflections of rectangular plates with nonlinear elasticity and hollow shells with hinge-supported edges, which are under the effect of external normal pressure uniformly distributed along the entire surface or along the central rectangular area. The curvature parameter values at which a crack in a cylindrical panel occurs are established. Critical loads and their corresponding deflections were found for panels with different curvature parameters. Author (GRA)

N73-22871# Teledyne Geotechnical, Alexandria, Va.
SLAMCODE: FINITE ELEMENT STRESS WAVE ANALYSIS
D. W. McCowan 14 Sep. 1972 62 p refs
(Contract F44620-69-C-0082; ARPA Order 1357)
(AD-755393; AL-72-1; AFOSR-73-0120TR) Avail: NTIS CSCL 20/11

The program SLAMCODE is a large Finite Element Method (FEM) code capable of dynamic analysis of transient problems. It was adapted from the original SLAMCODE written by C. J. Costantino (Costantino, 1968) by incorporating the implicit Newmark B-integration (Newmark, 1959) and by constraining the free surface to be stress free. The present code also differs from the original by not permitting plastic elements. It calculates solutions for axisymmetric, plane stress or plane strain problems, as in the original code. It is designed to run on the IBM 360 family of computers under OS/360. Although it is written in FORTRAN, it can be easily adapted to other computer systems. Computer program listings are included. GRA

N73-22872# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FURTHER EXPERIMENTAL STUDIES ON BUCKLING OF INTEGRALLY RING-STIFFENED CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION
Tanchum Weller and Josef Singer Apr. 1972 41 p refs
(Contract F61052-69-C-0040; AF Proj. 9782)
(AD-755392; TAE-138; AFOSR-73-0119TR; SR-6) Avail: NTIS CSCL 20/11

An experimental study of the buckling of closely spaced integrally stiffened cylindrical shells under axial compression was carried out to determine the influence of shell and ring geometry on the applicability of linear theory. Twenty-nine specimens fabricated from 7075-T6 aluminum alloy with different geometries were tested. Test specimens were designed to fail in general instability and under low critical stresses to assure elastic buckling. Author (GRA)

N73-22873# Naval Ship Research and Development Center, Annapolis, Md.
DETERMINATION OF THE DYNAMIC COMPLEX MODULI OF LINEAR VISCOELASTIC MATERIALS UTILIZING LASER INTERFEROMETRY: THEORETICAL CONSIDERATIONS
Bruce Edward Douglas Feb. 1973 50 p refs
(AD-755718; NSRDC-27-275; NSRDC-3915) Avail: NTIS CSCL 20/11

Two nonresonant techniques for determining the complex Young's modulus and complex shear modulus of linear viscoelastic materials are presented and analytically evaluated. The two methods are developed around the use of the laser interferometer because of its potential in extending the operational range of existing methods. The technique to measure the complex Young's modulus is based on the longitudinal vibration of a fixed-free homogeneous prismatic rod of viscoelastic material subjected to a compressional sinusoidal stress wave. The technique to measure the complex shear modulus is based on the torsional vibration of a fixed-free homogeneous circular rod of viscoelastic material subjected to a torsional sinusoidal stress wave. A brief parameter study is presented to examine the potential of both techniques along with an error analysis. Author (GRA)

N73-22874# Alabama Univ., Huntsville. School of Graduate Studies and Research.
USER'S MANUAL FOR DIGITAL COMPUTER PROGRAM AND DISPLACEMENTS OF ELASTIC MEMBRANES
John E. Key Dec. 1972 80 p refs
(Contract F44620-69-C-0124; AF Proj. 9560; Proj. Themis)
(AD-755953; UAH-RR-134; AFOSR-73-0196TR) Avail: NTIS CSCL 20/11

The report is a user's manual and listing for a general purpose UNIVAC 1108 FORTRAN computer program developed for the analysis of finite deformations of thin elastic membranes of arbitrary shape. The program employs the finite element method and an incremental loading technique for solving nonlinear equations. GRA

N73-22875# Naval Research Lab., Washington, D.C.
MAXIMIZATION AND MINIMIZATION OF DYNAMIC LOAD FACTORS Interim Report
George J. OHara 22 Dec. 1972 19 p refs
(SF43422110)
(AD-755168; NRL-7504) Avail: NTIS CSCL 20/11

The report presents in a heuristic manner a method of determining the maximum and minimum possible values of dynamic load factors for damped and undamped simple oscillators responding to applied forces defined by an amplitude tolerance curve. In the case of forcing functions of long duration, limit cycles are derived to show the rates at which resonance buildup occurs. A few sample problems are worked out by the method of exact transformations, and the results are presented. It is demonstrated that for light damping a significant variation can occur in dynamic load factors for band-limited pulse shapes. Author (GRA)

N73-22876# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
APPLICATIONS OF TRILINEAR COORDINATES TO SOME PROBLEMS IN PLANE ELASTICITY
R. Williams and H. F. Brinson Oct. 1972 108 p refs
(Contract DAAF07-69-C-0444)
(AD-755181; VPI-E-72-22) Avail: NTIS CSCL 20/11

The report considers some analytical aspects involved in the application of trilinear coordinates to boundary value problems in plane elasticity. Trilinear coordinates, also known as homogenous point coordinates, are defined. The concepts of triaxial stress, strain, bending moments and curvature are introduced. Using these concepts, the stress-strain relationship, moment-curvature relationship and a few other basic equations of two-dimensional elasticity are developed for an isotropic material. All these relationships are presented in matrix form - as an aid to finite element stress analysis. Governing equations corresponding to some two-dimensional problems in elasticity are deduced for the trilinear system. An investigation was carried out on the method of integration of a function composed to trilinear variables. A few functional relations between the trilinear variables are also developed. Author (GRA)

N73-22877*# Stanford Univ., Calif. Dept. of Applied Mechanics.
STABILITY OF A BEAM ON AN ELASTIC FOUNDATION SUBJECTED TO A FOLLOWER FORCE
T. E. Smith and George Herrmann May 1972 11 p refs
(Grants NGL-05-020-397; AF-AFOSR-1905-70; AF Proj. 9782)
(NASA-CR-131608; SUDAM-72-6; AD-746697;
AFOSR-72-0537TR) Avail: NTIS HC $3.00 CSCL 13/13

The purpose of this note is to draw attention to an intuitively unexpected and seemingly unknown aspect of the behavior of a cantilevered beam on an elastic foundation subjected to a follower at its free end. It is found that the critical load for flutter is independent of the foundation modulus which characterizes the Winkler-type elastic embedding. The frequency of vibration of the beam increases with increasing foundation modulus, but the magnitude of the critical load is not affected. This result is valid for any value of tangency coefficient. Author (GRA)

N73-22878# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
ON THE FREE VIBRATION OF A LONG HELICOIDAL MEMBRANE STRIP
Gerald H. Weidenhammer and James Sheng Sep. 1972 101 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-755239; Rept-72-32) Avail: NTIS CSCL 20/11

The equations of motion for a shell are developed in general orthogonal coordinates using Hamilton's principle. They are modified to yield a set of improved equations which are then transformed to helicoidal shell coordinates. The membrane portion of these equations is solved for the natural frequencies and associated mode shates for a uniformly twisted membrane boundary value problem. Author (GRA)

N73-22879# Bell Aerospace Co., Buffalo, N.Y.
MAGIC 3: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 1: ENGINEER'S MANUAL Final Report, 15 Mar. 1971 - 15 Mar. 1972
James R. Batt and Stephen Jordan Wright-Patterson AFB, Ohio AFFDL Jul. 1972 184 p refs 3 Vol.
(Contract F33615-71-C-1390; AF Proj. 1467)

(AD-755368; AFFDL-TR-72-42-Vol-1) Avail: NTIS HC $15.50/set of 3 reports as AD-755368-SET CSCL 20/11

An automated general purpose system for analysis is presented. This system, identified by the acronym MAGIC III for Matrix Analysis via Generative and Interpretive Computations, is an extension of the structural analysis capability available in the initial MAGIC System. MAGIC III provides a powerful framework for implementation of the finite element analysis technology and provides diversified capability for displacement, stress, vibration, and stability analyses. It is written in FORTRAN 4 for IBM 360/65 and CDC 6400 computers, and contains 477 subroutines. Additional elements have been added to the MAGIC element library in this phase of MAGIC development. These are the solid elements rectangular prism, tetrahedron, triangular prism, symmetric triangular prism, and triangular ring (asymmetrical loading). Also included are the symmetric shear web element and a revised quadrilateral thin shell element. The finite elements listed include matrices for stiffness, mass, prestrain load, thermal load, distributed mechanical load, pressure and stress. GRA

N73-22880*# Bell Aerospace Co., Buffalo, N.Y.

MAGIC 3: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 2: USER'S MANUAL Final Report, 15 Mar. 1971 - 15 Mar. 1972

Stephen Jordan and James R. Batt Wright-Patterson AFB, Ohio AFFDL Jul. 1972 455 p refs 3 Vol.

(Contract F33615-71-C-1390; AF Proj. 1467)

(AD-755369; AFFDL-TR-72-42-Vol-2) Avail: NTIS HC $15.50/set of 3 reports as AD-755368-SET CSCL 20/11

The report, Volume 2 of the MAGIC 3 system, contains system input and structural input data with examples of the computer output. The MAGIC 3 system is written in FORTRAN 4 for IBM 360/65 and CDC 6400 computers. GRA

N73-22881# Bell Aerospace Co., Buffalo, N.Y.

MAGIC 3: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 3: PROGRAMMER'S MANUAL Final Report, 15 Mar. 1971 - 15 Mar. 1972

A. Michael Gallo Wright-Patterson AFB, Ohio AFFDL Jul. 1972 723 p refs 3 Vol.

(Contract F33615-71-C-1390: AF Proj. 1467)

(AD-755370; AFFDL-TR-72-42-Vol-3) Avail: NTIS HC $15.50/ set of 3 reports as AD-755368-SET CSCL 20/11

The report, Volume 3 of the MAGIC 3 system, is the programmers' manual designed to facilitate implementation, operation, modification, and extension of the MAGIC 3 system. The MAGIC 3 system is written in FORTRAN 4 and has been implemented on IBM 360/65 and CDC 6400 computers. It includes 477 subroutines. GRA

N73-22882# Army Foreign Science and Technology Center, Charlottesville, Va.

AN ACCELERATED METHOD OF FATIGUE TESTING AND PARAMETERS OF FATIGUE CURVES

V. M. Grebenik 7 Feb. 1973 14 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 6, 1964 p 51-59

(AD-756050; FSTC-HT-23-925-72) Avail: NTIS CSCL 20/11

The article presents a method of accelerated fatigue testing. Data are presented which make it possible to significantly reduce the number of fatigue tests and to approach more correctly the construction of fatigue curves. These accelerated methods of fatigue testing may be developed on the basis of establishing dependencies between fatigue curves and other properties or mechanical characteristics of metals. This method is based on the hypothesis of the energy similarity of fatigue destruction and the melting of metals. GRA

N73-22883# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

THE BUCKLING OF SHELLS UNDER COMBINED LOADING AND THERMAL STRESSES Final Report

Josef Singer and Menahem Baruch Oct. 1972 22 p

(Contract F44620-71-C-0116; AF Proj. 9782)

(AD-756494; AFOSR-73-0302TR) Avail: NTIS CSCL 20/11

The studies described are part of a continuing investigation of the stability of stiffened and unstiffened shells under different loads and load combinations as well as heating. The purpose of the investigation is not only a better understanding of the phenomenon of buckling but also better methods of analysis and improved structural efficiency of aerospace vehicles. Author (GRA)

N73-22884# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

VIBRATIONS OF THICK ORTHOTROPIC CIRCULAR CYLINDRICAL SHELLS

Frank Romano and Alan P. Salzman Feb. 1973 99 p refs

(Contract N00014-67-A-0438-0006; NR Proj. 064-427)

(AD-756649; PIBAL-73-5) Avail: NTIS CSCL 20/11

Higher-order shell equations are developed for thick, orthotropic, circular cylinders undergoing axially symmetric, non-torsional, harmonic motion. Systems of governing equations for three, five, seven and nine mode theories are obtained from Reissner's variational principle by assuming stress and displacement states which include higher-order terms through the shell thickness. Frequency spectrums and mode shapes obtained from the solution of the resulting generalized characteristic-value problems are presented and compared to known elasticity solutions. Author (GRA)

N73-22885# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

HIGHER-ORDER SHELL THEORY FOR THICK CIRCULAR CYLINDERS UNDER ARBITRARY LOAD AND BOUNDARY CONDITIONS

Frank Romano and Eugene Golub Jan. 1973 111 p refs

(Contract N00014-67-A-0438-0006; NR Proj. 064-427)

(AD-756648; PIBAL-73-2) Avail: NTIS CSCL 20/11

Thick shell equations of circular cylinders under axisymmetric load are developed by assuming a stress and displacement state that is a generalization of the classical thin-shell theory, i.e. the in-plane stresses contain, in addition to the classical membrane and bending stress resultants. The governing differential equations and the associated boundary conditions are obtained by utilization of Reissner's variational principle in conjunction with the generalized stress and displacement state. Comparison of results obtained from known elasticity solutions shows that the present solution accurately represents the stress and displacement states for shells with mean radius to thickness ratios of the order of 3.0. Author (GRA)

N73-22886# Notre Dame Univ., Ind. Coll. of Engineering.

A VARIATIONAL PRINCIPLE FOR FINITE DEFORMATIONS OF QUASI-SHALLOW SHELLS

N. C. Huang Feb. 1973 25 p refs

(Contract N00014-68-A-0152; NR Proj. 260-112)

(AD-756187; UND-73-4) Avail: NTIS CSCL 20/11

A variational principle is established for treating the finite deformation of quasi-shallow shells. The special case corresponding to Marguerre's shallow shell theory is discussed. An example of snap-through of shallow cylindrical panels clamped at one of its curved edges is analyzed by the variational principle given here. Author (GRA)

N73-22887# Notre Dame Univ., Ind. Coll. of Engineering.

INELASTIC BUCKLING OF ECCENTRICALLY LOADED COLUMNS

N. C. Huang Jan. 1973 33 p refs

(Contract N00014-68-A-0152; NR Proj. 260-112)

(AD-756186; UND-73-3) Avail: NTIS CSCL 13/13

The inelastic buckling of eccentrically loaded simply supported columns of rectangular and circular cross sections is analyzed. The material of the column is assumed to satisfy Ramberg-Osgood's stress-strain relation. The load-carrying-capacity of the column is calculated by an iterative procedure for wide ranges of the geometry of the column and the eccentricity of the applied load. Author (GRA)

N73-22888# Notre Dame Univ., Ind. Coll. of Engineering.

SNAP-THROUGH BUCKLING OF A TOGGLE TRUSS IN CREEP

Cary K. Mak Feb. 1973 23 p refs

(Contract N00014-68-A-0152; NR Proj. 260-112)

(AD-756188; UND-73-5) Avail: NTIS CSCL 13/13

The snap-through buckling of a nonshallow toggle truss structure in creep is studied theoretically. The critical creep deflection and critical time for a truss obeying a nonlinear power creep law are presented and compared with the available results for a shallow truss. Author (GRA)

N73-22917* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

COMPOSITE STRUCTURES

Edwin L. Brown *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 13-18 (For availability see N73-22915 13-34)

CSCL 20K

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-22889 University of Southern Calif., Los Angeles.

ON THE THEORY OF FLAMMABILITY LIMITS Ph.D. Thesis

William Blaine Stine 1972 138 p

Avail: Univ. Microfilms Order No. 72-26059

An investigation was made to develop a method of analytically predicting the flammability limit of a combustible gas. The flammability limit is defined experimentally by diluting a flammable mixture of gases such as methane and air with one of its constituents or with other gases until the mixture is no longer flammable. The flammability limit is the borderline composition; a slight change in one direction produces a flammable mixture, in the other direction a nonflammable mixture. The one-dimensional, steady-state flame equations with heat loss distributed throughout the flame and with single-step Arrhenius type kinetics are solved by numerical integration on a digital computer. Heat loss due to conduction and radiation are included. A double iteration technique is described which permits starting the integration at the cold or reactant boundary and integrating toward the hot boundary with distance as the independent variable. A generally available integration program is used, and a copy of the computer code developed for these solutions is included. Dissert. Abstr.

N73-22890*# Denver Research Inst., Colo.

COMBUSTION DYNAMICS IN LIQUID ROCKET ENGINES Final Report

W. H. McLain Sep. 1971 282 p refs

(Contract NAS9-7566)

(NASA-CR-128898; DRI-2577) Avail: NTIS HC $16.25 CSCL 21B

A chemical analysis of the emission and absorption spectra in the combustion chamber of a nitrogen tetroxide/aerozine-50 rocket engine was conducted. Measurements were made under conditions of preignition, ignition, and post combustion operating periods. The cause of severe ignition overpressures sporadically observed during the vacuum startup of the Apollo reaction control system engine was investigated. The extent to which residual propellants or condensed intermediate reaction products remain after the engine has been operated in a pulse mode duty cycle was determined. Author

N73-22891*# SKF Industries, Inc., King of Prussia, Pa.

AIRCRAFT ENGINE SUMP FIRE MITIGATION

J. W. Rosenlieb 31 Jan. 1973 74 p refs

(Contract NAS3-14310)

(NASA-CR-121158; AL73T007) Avail: NTIS HC $5.75 CSCL 13L

An investigation was performed of the conditions in which fires can result and be controlled within the bearing sump simulating that of a gas turbine engine; Esso 4040 Turbo Oil, Mobil Jet 2, and Monsanto MCS-2931 lubricants were used. Control variables include the oil inlet temperature, bearing temperature, oil inlet and scavenge rates, hot air inlet temperature and flow rate, and internal sump baffling. In addition to attempting spontaneous combustion, an electric spark and a rub (friction) mechanism were employed to ignite fires. Spontaneous combustion was not obtained; however, fires were readily ignited with the electric spark while using each of the three test lubricants. Fires were also ignited using the rub mechanism with the only test lubricant evaluated, Esso 4040. Major parameters controlling ignitions were sump configuration, bearing and oil temperatures, hot air temperature and flow,and bearing speed. Rubbing between stationary parts and rotating parts (eg. labyrinth seal and mating rub strip) is a very potent fire source suggesting that observed accidental fires in gas turbine sumps may well arise from this cause. Author

N73-22892# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

A STUDY OF POST CRITICAL HEAT FLUX HEAT TRANSFER IN A FORCED CONVECTION SYSTEM

David N. Plummer, Onwuamaeze C. Iloeje, Peter Griffith, and Warren M. Rohsenow Mar. 1973 112 p refs Sponsored by GE

(DSR-73645-80) Avail: NTIS HC $7.75

A transient boiling experiment was conducted to acquire data in forced convection film, transition, and nucleate boiling regions for a specified pressure, quality and mass flux. Transient boiling experiments were conducted for water in a 0.492 inch I.D. inconel X-750 tube at mass fluxes of 50,000, 100,000 and 250,000 pounds mass per hour sq. feet, quality range of 30-100% and a pressure of 1000 psia. An empirical correlation was developed for this data for minimum film boiling temperature differences. The correlation was based on Berenson's minimum pool film boiling temperature difference correlation in order to provide a technique for extrapolating to different pressures. The film boiling data was compared against the Groeneveld Correlation and found to be considerably underpredicted by the Groeneveld Correlation. An empirical correction term was developed to use in conjunction with the Groeneveld Correlation to predict the experimental data. A calculation procedure is presented which predicts the heat transfer history of a boiling water reactor in the event of a loss-of-coolant accident. Author

N73-22893# Grumman Aerospace Corp., Bethpage, N.Y. Fluid Dynamics Section.

NONEQUILIBRIUM CLUSTER FORMATION IN ROCKET EXHAUSTS

R. A. Oman and V. S. Calia Mar. 1973 17 p refs

(RM-571) Avail: NTIS HC $3.00

The formation of large polymers in the vacuum plumes of large rocket engines was investigated. Monatomic species scaling concepts are applied to the molecular parameters of the water molecule in order to estimate its clustering behavior. The calculations indicate that the products of adiabatic combustion of hydrogen and oxygen will form clusters of several thousand water molecules if allowed to expand freely to vacuum. Experiments to define the basic cluster forming rates, cluster size distribution, and scaling relationships are described. Author

N73-22894*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

THERMAL CONTROL AND HEAT STORAGE BY MELTING AND FREEZING. SPACE THERMAL CONTROL DEVELOPMENT Interim Report

P. G. Grodzka and M. J. Hoover Mar. 1971 23 p refs

(Contract NAS8-25183)

(NASA-CR-124214; HREC-5183-1; LMSC/HREC-D162884) Avail: NTIS HC $3.25 CSCL 20M

Current results of an experimental study of increasing phase change material thermal diffusivity by means of solid fillers are reported. Aluminum honeycomb appears to offer the best improvement of any of the fillers investigated to date. Details of the experimental method developed in the present study for rapidly determining thermal diffusivities with a precision of about 10 percent are also reported. Further concepts regarding phase change material thermal diffusivity enhancement and of phase change material operation are discussed. Author

N73-22895# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
AN OSCILLATORY METHOD TO DETERMINE THE THERMAL DIFFUSIVITY COEFFICIENT OF GASES
J. Kielbasa 1973 28 p refs
(BER-1/73) Avail: NTIS HC $3.50

The method takes advantage of the phase distribution of a signal created around the linear oscillating heat source. For operation, the device generates a thermal signal in the gas studied thus establishing a signal oscillatiqn frequency so that signal phase retardation acquired on the way transmitter-detector equal to pi. Theoretical grounds of the method and a brief theory of the measuring instrument are given and experimental results obtained with several different gases are outlined. Author

N73-22896# Oxford Univ. (England). Cryogenics Lab.
HEPROP: A COMPUTER PROGRAMME FOR THE THERMOPHYSICAL PROPERTIES OF HELIUM
B. A. Hands 12 Jan. 1973 97 p refs
(Rept-1046/72) Avail: NTIS HC $7.00

HEPROP is a set of subprograms used to calculate the thermophysical properties of helium. The thermodynamic properties are derived from an equation of state which is valid from about 2K to 1700K, and up to about 10 sup 8 Nm minus 2. By analytical differentiation and integration, pressure, enthalpy, and entropy are calculated as a function of density and temeprature. Equations are provided for pressure, liquid density and vapor density at saturation, thus enabling saturation properties to be calculated. Author (ESRO)

N73-22897# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRAULICS AND HEAT EXCHANGE IN ELEMENTS OF POWER EQUIPMENT
V. M. Borishanskii, A. A. Andreevskii, and V. N. Fromzel 30 Oct. 1972 529 p refs Transl. into ENGLISH from the monograph "Gidravlika i Teploobmen v Elementakh Energeticheskogo Oborudovaniya" Leningrad, 1970 p 1-343
(AD-756564; FTD-MT-24-309-72) Avail: NTIS CSCL 20/13

The first section includes reports on the intensity of heat exchange, critical loads, and thermal modes in elements of power equipment during the motion of two-phase flow. The second section deals with a study of the hydrodynamics of two-phase steam-water flows, stability, hydraulic resistance, and phase distribution during the motion of two-phase flow in channels of various shapes. The third section includes works on the intensity of heat transfer during film and droplet condensation, the condensation of liquid-metal vapors from a flow of inert gases, condensation on surfaces of various shapes (condensation on ribbed surfaces, vapor condensation during cross-spiral flow around vertical duct banks), as well as the results of a study on steam turbine surface condensers. Author (GRA)

N73-22898# Army Foreign Science and Technology Center, Charlottesville, Va.
COMBUSTION OF BINARY SYSTEMS IN RAREFIED AIR
G. A. Mokhov 9 Jan. 1973 19 p refs Transl. into ENGLISH from Fiz. Aerodispersnykh Sistem (Kiev), v. 3, 1970
(AD-756043; FSTC-HT-23-1842-72) Avail: NTIS CSCL 21/2

Measurements of linear combustion rates, flame radiation intensities, and flame radiation spectra were measured for the combustion of binary pyrotechnic compositions under air pressure from 760 down to 10 mm Hg. The data are explained on the basis of a scheme for combustion of heterogeneous systems. Author (GRA)

N73-22899# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
COMBUSTION TRANSIENTS OF SOLID PROPELLANTS Final Report
Norman W. Ryan and Alva D. Baer 28 Feb. 1973 71 p refs
(Grant AF-AFOSR-1656-69; AF Proj. 9711)
(AD-757234; AFOSR-73-0437TR) Avail: NTIS CSCL 21/2

The report is largely a restatement of conclusions, with reference to previous publications for details. The areas of study reported are an evaluation of the hot-wire-ignition method for characterizing propellants; the development and study of a gas-fueled analog of the solid-propellant T-burner; a study of low frequency (L*) combustion of L* during a test; a study of high frequency acoustic instability of solid propellants, both a T-burner and a radial-mode, radial-flow burner being used with the same propellants systems; the development and evaluation of a technique for measuring the solid-propellant response function to external energy perturbations at the burning surface; the measurement and evaluation of transient temperatures of propellant flames during rapid depressurization; and a detailed characterization of the low-pressure-combustion phenomena for several different solid propellants including studies of the low-pressure deflagration limit, the electrical conductance near the surface, the extinguishment requirements, and spontaneous reignition. Author (GRA)

N73-22900*# ARO, Inc., Arnold Air Force Station, Tenn.
HEAT-TRANSFER INVESTIGATION OF LANGLEY RESEARCH CENTER DELTA WING CONFIGURATIONS AT MACH NUMBERS 8 AND 10.5 Final Report, Jun. - Sep. 1971
R. H. Eaves, Jr., R. K. Matthews, and T. D. Buchanant AEDC Feb. 1973 44 p refs Sponsored in part by NASA and AF (ARO Proj. VT1162)
(NASA-CR-131485; AD-755355; ARO-VKF-TR-72-160; AEDC-TR-72-196) Avail: NTIS HC $4.25 CSCL 22/2

Heat-transfer tests for two simple delta wing configurations submitted by NASA-Langley Research Center were conducted at Mach numbers 8 and 10.5. Test conditions provided both Mach number and Reynolds number simulation for typical lifting body reentry trajectories. This report presents the major test results and comparisons with theoretical calculations. Specific test results include heat-transfer distributions, shock angles, limited pressure measurements, and boundary-layer transition results. Author (GRA)

N73-22901# Army Foreign Science and Technology Center, Charlottesville, Va.
RELATIONSHIP BETWEEN PARAMETERS OF CYLINDER SOLIDIFICATION IN AXIAL AND RADIAL AXIAL HEAT TRANSFER
F. L. Shved and D. A. Soskov 21 Dec. 1972 5 p Transl. into ENGLISH from Inzh-Fiz. Zh. (Minsk), v. 19, no. 1, 1970 p 106-109
(AD-755871; FSTC-HT-23-1997-72) Avail: NTIS CSCL 07/4

A method to calculate the temperature field of the crystallization zone (two-phase zone) moving in a cylinder along its axis is described. GRA

N73-22902# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VIBRATION COMBUSTION IN CERTAIN MODEL DEVICES
A. D. Margolin [Oct. 1972] 288 p refs Transl. into ENGLISH of the publ. "Vibratsionnoe Gorenie v Nekotorykh Modelnykh Ustroystvakh" Kazani Kazan Univ., 1970 p 1-167
(AD-755712; FTD-MT-24-599-72) Avail: NTIS CSCL 21/2

The Russian report contains the investigations connected with the vibration combustion of gases, powders, and carbon particles. This collection includes articles which relate to three types of simulation used in the research on vibration combustion: Those geometrically similar to the full-scale device of the model; Those intended for studying the individual forms of vibration combustion of the mechanism; and, Those intended for detailed research on individual components of vibration combustion (for example, the interaction of flames with shock waves). Author (GRA)

N73-22903# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
COMBUSTION INSTABILITY IN A GAS-FIRED T-BURNER Scientific Report
William W. Sipowicz 29 Dec. 1972 141 p refs
(Grant AF-AFOSR-1956-69; AF Proj. 9711)
(AD-755824; AFOSR-73-0265TR) Avail: NTIS CSCL 21/2

Premixed natural gas-nitrogen-oxygen mixtures were introduced through a permeable frit and burned in a T-burner. Oscillatory combustion remarkably like that observed in a propellant-fueled burner was observed. In the range of ignitable mixtures, strong amplification was obtained in both lean and slightly rich mixtures, the two regions merging as diluent nitrogen was added. The effects of changing frequency and mass flow

rate were also investigated. It is inferred that gas-phase kinetics may play a significant role in the oscillatory process.
Author (GRA)

N73-22904# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
COMBUSTION INSTABILITY IN A RADIAL BURNER Scientific Report
Robert G. Mantyla and Norman W. Ryan 29 Dec. 1972 192 p refs
(Grant AF-AFOSR-1656-69; AF Proj. 9711)
(AD-755826; AFOSR-73-0270TR) Avail: NTIS CSCL 21/2

A burner was developed for and employed in a study of acoustic combustion instability of solid propellants. The objective was to observe oscillations in the radial mode, and to compare their characteristics with those observed in T-burner experiments. It was found that the radial modes are difficult to excite without the appearance also of tangential modes. Growth constants for the first tangential mode (radial burner) and the first longitudinal mode (T-burner) did not bear the theoretically predicted relationship. The radial burner is more difficult to use than a T-burner and does not produce more easily interpretable data.
Author (GRA)

N73-22905# Army Foreign Science and Technology Center, Charlottesville, Va.
DYNAMIC PROBLEMS OF VISCOPLASTIC MEDIA IN A TEMPERATURE FIELD
D. Kolarov and A. Baltov 8 Jan. 1973 24 p refs Transl. into ENGLISH from the Russian
(AD-755274; FSTC-HT-23-2050-72) Avail: NTIS CSCL 20/11

The report is a study of the propagation of waves in an elastic-viscoplastic medium under temperature conditions. The basic mechanical-mathematical models of viscoplastic media are examined together with the changes in their mechanical properties and characteristics under the influence of the temperature field. The basic system of differential equations for the problem is given. The effect of various parameters is studied and conditions are obtained under which non-elastic waves can exist. Special attention is given to acceleration waves and the characteristic changes in their parameters are studied during the propagation process. Various initial and boundary value conditions which can occur are given. A suitable method for solving approximately the system of differential equations which formulate the problem in the three-dimensional case is given. Conditions on characteristic surfaces and bicharacteristic lines are given. Certain special cases of the general problem are examined. Author (GRA)

N73-22906# TRW Systems, Redondo Beach, Calif. Fluid Mechanics Lab.
ANALYTIC STUDIES IN BURNING OF INITIALLY UNMIXED REACTANTS Final Report, 1 Nov. 1966 - 31 Dec. 1972
Francis E. Fendell 31 Dec. 1972 16 p refs
(Contract DAHC04-67-C-0015; DA Proj. 2O0-14501-B-33G)
(AD-755214; AROD-6453-35-E) Avail: NTIS CSCL 21/2

The report reviews a project which has attempted to indicate that the information of primary interest to combustion engineers can be extracted readily by exploiting physical insight confirmed by singular-perturbation analysis. The report only summarizes and lists the author's publication. The tractability of flows involving convection, diffusion, and finite-rate chemical reaction to rapid, approximate analysis by modern asymptotic methods has been demonstrated through solution of a variety of engineering problems. Problems treated involved both detonations and deflagrations, free and forced convection, laminar and turbulent flows, premixed and unpremixed flames, and a variety of flow geometries. GRA

N73-22907# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
COAGULATION OF CARBON PARTICLES IN PREMIXED FLAMES
B. L. Wersborg (MIT, Cambridge, Mass.), J. B. Howard (MIT, Cambridge, Mass.), and G. G. Williams (MIT, Cambridge, Mass.) Dec. 1972 37 p refs
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID Headquarters)
(AD-755693; SQUID-TR-MIT-72-PU) Avail: NTIS CSCL 21/2

The size distribution, number concentration, and fraction charged of carbon particles at successive stages of formation in a low pressure flat flame were measured using molecular beam sampling involving electrical beam deflection and electron microscopy of beam deposits and an optical absorption technique. Observed cluster-type structure within roughly spherical particles and decreasing particle number concentration following rapid nucleation indicate the particles do indeed coagulate during growth. Particle size and number concentration data confirm this conclusion although the experimental coagulation rate exceeds by a factor of about 10 the kinetic energy collision rate approximately adjusted for elastrostatic forces, based upon the measured extent of particle charging, and Van der Walls attraction. Calculations based upon extrapolation of the experimental coagulation rate constant into the flame region of significant particle nucleation and surface reaction are discussed.
Author (GRA)

N73-22908# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL EXCHANGE APPARATUS FOR VISCOUS LIQUIDS
V. A. Andreev 26 Dec. 1972 222 p refs Transl. into ENGLISH from the monograph "Teploobmennye Aparaty Dlya Vyzakikh Zhidkostei (USSR), 1971 p 1-51
(AF Proj. 7343)
(AD-756947; FTD-HC-23-734-72) Avail: NTIS CSCL 13/1

The report describes principles of calculation and design of heat transfer apparatus for viscous liquids, liquid fuel, and lubricating oils. Also given are physico-technical characteristics of these liquids and a number of practical recommendations.
Author (GRA)

N73-22909# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMODYNAMIC FORCES AND FLOWS IN A MAGNETIC FIELD
L. Astrishchenko 21 Dec. 1972 6 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Energ. (Minsk), no. 10, 1970 p 129-132
(AD-756901; FSTC-HT-23-2080-72) Avail: NTIS CSCL 07/4

The Gibbs equation is used under the assumption that for small volume elements in local equilibrium, the local entropy is a function of the specific energy, the specific volume, the magnetic field strength, and the mass concentration, just as in total equilibrium. The authors consider the case when the system is a physical mixture of components with different magnetic susceptibilities, and is situated in an inhomogenous magnetic field. GRA

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-22910 Ohio State Univ., Columbus.
SPATIAL ANALYSIS OF DOMESTIC UNITED STATES AIR PASSENGER TRAFFIC: A NETWORK ANALYSIS APPROACH Ph.D. Thesis
Budd Hansel Hebert 1972 431 p
Avail: Univ. Microfilms Order No. 72-27422

An algorithm, the Out-of-Kilter Algorithm, is used to evaluate the efficiency of passenger capacity provided by selected air transport carriers in the United States. Based upon data collected from the Official Airline Guide, including the number and type of aircraft, air passenger generating cities in the United States. Data were then taken from the Civil Aeronautics Board publication, Domestic Origin Destination Survey of Airline Passenger Traffic, to provide the numbers of air passengers flown between these twenty cities. Finally, the direct operating cost of transporting passengers over each arc connecting the twenty cities was computed. Dissert. Abstr.

N73-22911# Office of the Secretary of Transportation, Washington, D.C.
NATIONAL TRANSPORTATION REPORT, 1972: PRESENT STATUS, FUTURE ALTERNATIVES
Jul. 1972 449 p refs
(Rept-72-02328) Avail: NTIS MF $0.95; SOD HC $3.25

A comprehensive overview and future outlook of transportation are presented. Estimates of investment needs and program priorities as seen by states, local governments, and the private sector are included along with analyses of selected issues in urban and intercity transportation. Guidelines for future action by federal, state, and local governments, and the private sector are provided. Author

N73-22912# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
CLEAN AND ATTRACTIVE URBAN POWER SYSTEMS
James T. Yen Aug. 1972 36 p refs Presented at the Intersociety Energy Conservation Eng. Conf., San Diego, Calif., 25-29 Sep. 1972
(RE-439J) Avail: NTIS HC $4.00

The siting and waste problems facing the power industry at the present time are examined. It is proposed that these problems be resolved by integrating clean power plants into community centers. This can be done in such a way that not only power but also year-round recreation and job-training will be enjoyed and utilized by the residents. More specifically, the result is a new type of integrated system that is comprised of total energy gas turbine power plants to be located in underground sites within the community centers, and year-round recreation, job-training, and other facilities to be designed to suit local needs and to be located within the same community centers. Author

N73-22913*# Boeing Co., Seattle, Wash.
SYSTEM SAFETY ENGINEERING ANALYSIS HANDBOOK
Terry E. Ijams [1972] 230 p refs
(Contract NASw-1650)
(NASA-CR-131886; D2-119062-1) Avail: NTIS HC $13.50 CSCL 05A

The basic requirements and guidelines for the preparation of System Safety Engineering Analysis are presented. The philosophy of System Safety and the various analytic methods available to the engineering profession are discussed. A textbook description of each of the methods is included. Author

N73-22914*# University of Southern Calif., Los Angeles. Western Research Application Center.
[RESEARCH PROGRESS ON DISEASE DATA BANK AND DATACON SYSTEMS] Quarterly Porgress Report, 1 Nov. 1972 - 31 Jan. 1973
31 Jan. 1973 45 p
(Contract NASw-2360)
(NASA-CR-131568; QR-4) Avail: NTIS HC $4.25 CSCL 05A

Developments and specific statistics for this reporting period are presented. The administration, community activities, funding, personnel, marketing and public relations, technical operations, information systems, and technology transfer are discussed. F.O.S.

N73-22915*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ACHIEVEMENTS REVIEW. VOLUME 4, REPORT NO. 7: PROCESS ENGINEERING RESEARCH AT MSFC
Feb. 1973 143 p refs
(NASA-TM-X-64723) Avail: NTIS HC $9.25 CSCL 05A

Research projects conducted by the laboratories of the Marshall Space Flight Center are discussed. The period covered is May 1970 through May 1972. The subjects presented are: (1) flat conductor cable development, (2) composite structures, (3) galvanic forming, (4) electron beam welding, (5) manufacture of quartz gyroscopes, (6) Apollo 14 composite casting demonstration, (7) manufacturing processes in zero gravity conditions, (8) neutral buoyancy space simulation, (9) electrocardiogram and cardiotachometer system, and (10) free flying teleoperator systems. For individual titles, see N73-22916 through N73-22925.

N73-22916* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLAT CONDUCTOR CABLE DEVELOPMENT c09
Ralph Herndon *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 1-11 (For availability see N73-22915 13-34)
CSCL 09A

The capability for developing flat conductor cable for use in space applications is discussed. A history of the flat cable conductors, the components of a typical flat conductor cable system, advantages and disadvantages, and various applications are examined. Seven methods of fabricating flat conductor cable are outlined. Illustrations of flat conductor construction and installation are included. Author

N73-22917* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPOSITE STRUCTURES c32
Edwin L. Brown *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 13-18 (For availability see N73-22915 13-34)
CSCL 20K

A review of the research and development efforts required to assess and develop the technology for applications of fiber composites to space shuttle structural hardware is presented. It is concluded that advanced, lightweight, high strength structural materials must be used to maximize the orbital payload capability. Several areas where boron-epoxy, boron-polyimide, boron-aluminum, and graphite materials may be used to attain weight reduction are analyzed. Weight saving possibilities in various space shuttle vehicles are presented in tabular form. Author

N73-22918* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GALVANIC FORMING c15
L. C. Jackson *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 19-25 (For availability see N73-22915 13-34)
CSCL 13H

Complex hardware configurations consisting of items such as small experimental blast nozzles for wind tunnel use, metallic shielding for cable-shape transformation joints, and slit masks utilized in production of thin-film hybrid microcircuits by vacuum evaporation have been produced by galvanic forming techniques. The techniques developed for fabrication, the availability of new processes that exhibit unusual properties or combinations of properties, and the combination of other processes with galvanic forming to produce unusual results are presented. Author

N73-22919* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VERSATILITY IN ELECTRON BEAM WELDING: A RATIONAL APPROACH
R. V. Hoppes *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 27-35 refs (For availability see N73-22915 13-34)
CSCL 13H

Electron beam welding techniques and applications are discussed. Beginning with an account of experiences in aluminum welding, an approach to and present status of electron beam welding versatility and the use of electron beam welding under space conditions are analyzed. Illustrations of equipment used in electron beam welding are presented. The effects of electron beam welding on the physical properties of various metals are examined. Author

N73-22920* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
QUARTZ GYRO MANUFACTURING AND MEASURING c21
John R. Rasquin *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 37-43 (For availability see N73-22915 13-34)
CSCL 17G

The unique methods used in the manufacture of quartz gyroscopes for the General Relativity Satellite are presented herein. The General Relativity Satellite will be used to verify Einstein's

general theory of relativity. If Einstein's predictions are correct, there will be two extremely small precession effects on a gyroscope in earth orbit. The precision techniques used to manufacture and measure some of the parts for the gyroscope are described. Author

N73-22921* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APOLLO 14 COMPOSITE CASTING DEMONSTRATION **c15**
I. C. Yates *In its* Res. Achievement Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 45-66 (For availability see N73-22915 13-34)
CSCL 13H

The processes of melting, mixing, and solidification of metal matrix composite materials in a weightless environment are discussed. Evaluation of the samples has shown that in a weightless environment more homogeneous dispersions of particles, fibers, or gases may be achieved in a metal matrix and that dispersions of immiscible liquids may be maintained during solidification. The apparatus and procedures for conducting composite casting under weightless conditions are described. Author

N73-22922* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL STUDIES OF MANUFACTURING PROCESSES PERFORMED IN ZERO-G **c15**
Vaughn H. Yost *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 67-106 refs (For availability see N73-22915 13-34)
CSCL 13H

Manufacturing in space conducted in support of the Skylab program and in anticipation of future programs is summarized. Methods used to obtain short periods of near-zero-g are illustrated, and the advantages and disadvantages of each are listed. Four experiments developed to investigate three manufacturing-in-space processes are illustrated, their operating sequence is described, and the results of each are presented. Author

N73-22923* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NEUTRAL BUOYANCY SPACE SIMULATION **c11**
James L. Splawn *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 107-111 (For availability see N73-22915 13-34)
CSCL 14B

The MSFC Neutral Buoyancy Simulator, which is used to duplicate the weightless condition experienced by astronauts, is described herein. The Simulator consists of a tank of water 75 ft in diameter by 40 ft deep, full scale mockup hardware, communication and recording instrumentation, and special subsystems to insure the safety of the test subjects. The principal advantages of this neutral buoyancy technique for hardware configuration definition and crew procedural training over other methods are validated. Author

N73-22924* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EKG ISOLATOR AND CARDIOTACHOMETER SYSTEM **c05**
Hubert E. Smith *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 113-117 (For availability see N73-22915 13-34)
CSCL 06B

An electrocardiogram (EKG) isolator to protect test subjects from electric shock in event of malfunction is described. The hazards connected with the use of EKG equipment are discussed. The equipment and circuits which were developed to protect the patient from accidental electrocution are presented. The development of a cardiotachometer system for use with the EKG isolator to visually display the heart rate is presented. The cardiotachometer is a digital system which uses the time between two consecutive pulses to calculate and display the heart rate in beats per minute. Author

N73-22925* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FREE FLYING TELEOPERATOR **c05**
Herman T. Blaise *In its* Res. Achievements Rev., Vol. 4, Rept. No. 7 Feb. 1973 p 119-133 (For availability see N73-22915 13-34)
CSCL 05H

The development and evaluation of free flying teleoperators are discussed. The free flying teleoperators include a wide spectrum of manipulator and maneuvering devices ranging from those that are directly controlled by a human operator, through supervisory control, to relatively autonomous control. The factors influencing space teleoperator development are listed as: (1) terrestrial experience of operating mechanical/electrical devices in a hostile environment, (2) a need to extend human capability in space, (3) to reduce the space and planetary exploration costs, and (4) to contribute to astronaut safety. Author

N73-22926# Urban Systems Research and Engineering, Inc., Cambridge, Mass.
LAND USE CONTROL STRATEGIES FOR AIRPORT IMPACTED AREAS Final Report May 1971 - Oct. 1972
Oct. 1972 185 p refs
(Contract DOT-FA71WA-2579)
(FAA-EQ-72-1) Avail: NTIS HC $11.25

Conversion of land near airports from residential and other airport-incompatible uses to commercial, industrial, or other airport-compatible uses is treated as providing a potential solution to the airport noise problem. This study developed a methodology for analyzing the feasibility of redevelopment and applied it in four case study airport areas: Los Angeles International, Miami International, Long Island-MacArthur (Islip, N. Y.), and Dallas-Fort Worth. The study examined existing land use patterns, the impact of current land use controls, prices for incompatible land, the market for compatible reuses of impacted land, community participation in redevelopment, and institutional and political barriers to successful redevelopment. The study found incompatible land uses prevalent and increasing in all areas. Redevelopment was found to be an effective and permanent but generally very expensive solution, because of high land acquisition costs and low demand for reuses. Redevelopment can be justified only in selected, small, heavily impacted areas. Author

N73-22927# Committee on Science and Astronautics (U. S. House).
SCIENCE, TECHNOLOGY, AND THE ECONOMY Interim Report of the Subcommittee on Science, Research, and Development
John W. Davis Washington GPO Feb. 1972 44 p refs Presented by Subcomm. on Sci., Res., and Develop. to the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 16 Feb. 1972
Avail: US Capitol, House Document Room

A detailed study by the Subcommittee on Science, Research, and Development concerning the relationship between science, technology, and the economy is presented. The objective is to answer two questions: what total resources should the United States invest in research and development in both the public and private sectors, and what are the optimum ways for making these investments? This interim report reviews the progress of the study and identifies those legislative issues which the subcommittee feels deserve further considerations by the Congress. Author

N73-22928# Committee on Science and Astronautics (U. S. House).
THE FEDERAL GOVERNMENT AND ENERGY RESEARCH AND DEVELOPMENT HISTORICAL BACKGROUND
Washington GPO Mar. 1973 111 p refs Presented by Subcomm. on Energy to the Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 20 Mar. 1973 Prepared by Library of Congr.
Avail: US Capitol, House Document Room

A congressional study is reported on the history of American energy production methods and techniques aimed at a comprehensive national energy research and development policy. Pertinent testimony was obtained from such authorities as the Department of the Interior, the National Bureau of Standards, the Federal Power Commission, the Tennessee Valley Authority, NASA, and sources from private industry. Results of the study

revealed the need for a unified national policy directly sensitive to increased present and future power requirements. J.M.M.

N73-22929# Committee on Science and Astronautics (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Olin E. Teague Washington GPO 1973 191 p Rept. on H.R. 7528 presented by Comm. on Sci. and Astronaut. to the Comm. of the Whole House on the State of the Union, 93d Congr., 1st Sess., 9 May 1973
(H-Rept-93-171) Avail: US Capitol, House Document Room

The authorized appropriation for fiscal year 1974 to NASA for research and development, constructions of facilities, and research and program management are reported. The R and D appropriation includes space flight operations, space shuttle, advanced missions, physics and astronomy, lunar and planetary exploration, launch vehicle procurement, space applications, aeronautical research and technology, tracking and data acquisition, and technology utilization. The construction/modification projects are listed along with the research and program management appropriations for government installations. F.O.S.

N73-22930# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1974, PART 1
Washington GPO 1973 275 p Hearings on H.R. 4567 (superseded by H.R. 7528) before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 1, 20-22 Mar. 1973
Avail: Comm. on Sci. and Astronaut.

Hearings are presented which focus upon NASA program achievements during 1973, as well as on projected plans for 1974 and beyond. These past and future programs include activities in manned spaceflight, space sciences, aeronautical research and technology, technology utilization benefits in various fields, and international cooperation in space exploration. From the perspective of these activities NASA budgetary appropriations for fiscal year 1974 are discussed and evaluated. J.M.M.

N73-22931*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF A MULTIFILTRATION WATER RECLAMATION SUBSYSTEM TO RECLAIM DOMESTIC CLOTHES WASH WATER
John B. Hall, Jr. Washington May 1973 27 p
(NASA-TM-X-2781; L-8831) Avail: NTIS HC $3.00 CSCL 06I

An evaluation has been performed of a multifiltration water reclamation subsystem to determine its capability to recover water from domestic clothes wash water. A total of 32.89 kg (72.5 lb) of clothes were washed during eight wash cycles which used 1.4 lb of detergent, 145 gallons of hot water and 133.9 gallons of cold water. Water recovered at a weighted average process rate of 3.81 gallons per hour met the majority of the 23 requirements established for potable water by the U.S. Public Health Service. Average power consumed during this evaluation was approximately 71 watt-hours per gallon of water recovered. Filter replacement, which was required primarily for the control of micro-organisms in the recovered water averaged 4.86 filters per 100 gallons of wash water processed. The subsystem removed approximately 98 percent and virtually 100 percent of the phosphates and surfactants, respectively, from the wash water. Author

N73-22932*# California Univ., Berkeley. Inst. of Transportation and Traffic Engineering.
FORECASTING THE DEMAND POTENTIAL FOR STOL AIR TRANSPORTATION
Shing-Leung Fan, Robert Horonjeff, Adib Kanafani, and Abdollah Mogharabi Feb. 1973 127 p refs
(Contract NAS2-6717)
(NASA-CR-114572) Avail: NTIS HC $8.50 CSCL 05C

A process for predicting the potential demand for STOL aircraft was investigated to provide a conceptual framework, and an analytical methodology for estimating the STOL air transportation market. It was found that: (1) schedule frequency has the strongest effect on the traveler's choice among available routes, (2) work related business constitutes approximately 50% of total travel volume, and (3) air travel demand follows economic trends. F.O.S.

N73-22933# Federal Aviation Administration, Washington, D.C.
A LOOK AT TOURISM POTENTIAL, PART 3
R. B. Bratbak May 1972 26 p
Avail: NTIS HC $3.50

A survey of U.S. tourism potential is presented. Hypotheses concerning the economic stages of nations and individual travel preferences are discussed. F.O.S.

N73-22934# Committee on Armed Services (U. S. Senate).
WEAPON SYSTEMS ACQUISITION PROCESS
Washington GPO 1972 46 p Hearing before Comm. on Armed Serv., 92d Congr., 2d Sess., 12 May 1972
Avail: Comm. on Armed Serv.

The Committee on Armed Services for the United States Congress considers the development of a prototype lightweight fighter aircraft. Weapon systems acquisition aspects of funding, planning, and management are discussed. G.G.

N73-22935*# Kanner (Leo) Associates, Redwood City, Calif.
TECHNICAL CHRONICLE: WHO RUNS THE PROGRAM OF MASTERING SPACE IN THE USSR?
S. Yu. Protsyuk Washington NASA May 1973 30 p refs Transl. into ENGLISH from Ukrainian Eng. News (USSR), v. 23, no. 3-4, 1972 p 60-72
(NASA-TT-F-14882) Avail: NTIS HC $3.50 CSCL 05A

The leading scientists of the U.S.S.R. space programs are identified. Inaccuracies in Western reporting are noted. Author

N73-22936# Groupe des Recherches Ionospheriques, Paris (France).
WORK DONE UNDER THE RESEARCH AGREEMENTS OF THE CENTRE NATIONAL D'ETUDES SPATIALES: FR-1 PROGRAM, ELECTRODYNAMIC PROBES, ELECTROSTATIC PROBES, AND TEST FACILITIES Progress Report, 1 Jul. 1972 [ETAT D'AVANCEMENT AU LER JUILLET 1972 DES TRAVAUX EFFECTUES DANS LE CADRE DES CONVENTIONS DE RECHERCHES DU CENTRE NATIONAL D'ETUDES SPATIALES: PROGRAMME FR-1, SONDES ELECTRODYNAMIQUES, SONDES ELECTROSTATIQUES ET MOYENS D'ESSAIS]
31 Aug. 1972 75 p refs In FRENCH
(GRI/NTP/103) Avail: NTIS HC $5.75

The work carried out under the CNES in the following fields was reported: FR-1 satellite (data processing, extremely low frequency wave propagation in the ionsophere, etc.), electrodynamic probes (quadropolar probes in isotropic and anisotropic thermal plasmas), electrostatic probes (ionospheric plasma control simulation, electrical properties of surfaces of plasma immersed probes, ionospheric experiment EIDI-3, and failure analysis of the electronic density Sayers probe onboard the FR-1 satellite). ESRO

N73-22937# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SECOND SOLITAIRE CALIBRATION EXPERIMENT
D. D. Powlette 1 Feb. 1973 39 p refs
(Contract F19628-73-C-0002; AF Proj. 627A)
(AD-756845; TN-1973-6; ESD-TR-73-58) Avail: NTIS CSCL 17/5

The report gives the results of an experiment in which the mount angle readout system of an infrared, acquisition-tracking system (SOLITAIRE) was calibrated using an Air Force aircraft as a target. These angle data, which were obtained from a 15-bit digital shaft angle encoder system, are compared to angle data from several radars at White Sands Missile Range. The SOLITAIRE NFOV azimuth data agreed, in general, to within 0.1 degree of the radar data; the NFOV elevation data agreed to within 0.1 degree average elevation angles of the radars. The SOLITAIRE WFOV encoder data differed from the NFOV data by less than plus or minus 0.02 degree in azimuth and was about 0.08 degree low in elevation. Target position was determined to within approximately 20 meters by triangulating between the RAMPART and SOLITAIRE azimuths and elevations when the target range was about 39 km and 32 km from RAMPART and SOLITAIRE, respectively. Author (GRA)

N73-22938# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NUCLEAR MISSILE AND ITS DESTRUCTIVE EFFECT
A. I. Ivanov, I. A. Naumenko, and M. P. Paulov 10 Nov. 1972 271 p refs Transl. into ENGLISH of the publ. "Raketno-Yadernoe oruzhie i Ego Porazhayushchee Desistive" Moscow, Min. Oborony SSR 1971 p 1-224
(AF Proj. 3908)
(AD-756565; FTD-MT-24-346-72) Avail: NTIS CSCL 15/6

The report contains discussion of the physical principles and design of the nuclear rocket weapon and its destructive effect. The book presents data concerning the design of atomic and thermonuclear munitions and rocket carriers, concerning methods of calculating the destruction zone and protective measures against nuclear-missile attack. The plans for the use by imperialists of space war is discussed. The destructive effect of atomic explosions in space is outlined. The material for the book is drawn from unclassified Soviet and foreign materials. Author (GRA)

N73-22939*# George Washington Univ., Washington, D.C. Program of Policy Studies in Science and Technology.
TECHNOLOGY AND PUBLIC POLICY: THE PROCESS OF TECHNOLOGY ASSESSMENT IN THE FEDERAL GOVERNMENT. SUMMARY REPORT
Vary T. Coates Jul. 1972 50 p 3 Vol.
(Grants NGL-09-010-030; NSF GI-30422)
(NASA-CR-131846; PB-211455) Avail: NTIS HC $4.50 CSCL 05A

The report describing the process of planning, programming, and evaluating technological projects and programs as carried out by offices within federal executive agencies is summarized. Author (GRA)

N73-22940*# George Washington Univ., Washington, D.C. Programs of Policy Studies in Science and Technology.
TECHNOLOGY AND PUBLIC POLICY: THE PROCESS OF TECHNOLOGY ASSESSMENT IN THE FEDERAL GOVERNMENT. VOLUME 1: FINAL REPORT
Vary T. Coates Jul. 1972 355 p refs 3 Vol.
(Grants NGL-09-010-030; NSF GI-30422)
(NASA-CR-131848; PB-211453) Avail: NTIS HC $19.75 CSCL 05A

A descriptive and analytical study was made of the process of planning, programming, and evaluation of technological projects and programs as carried out by 86 offices within federal executive agencies. The focus is on the extent to which techniques of technology assessment are used, based on interviews with 115 officials. Ninety-seven illustrative studies are analyzed as to their initiation, sponsors, research teams, methodology, duration, level of effort, and dissemination. The report considers technology assessment activity in the areas of food and fibers, housing, biomedical, water resources, power generation, minerals extraction, and transportation technology. It concludes that the federal technology assessment process has been broadened in the last five years to give increased attention to secondary consequences of technology but that the improvement is slow and differs from agency to agency. Recommendations for further improvement are offered. A bibliography on technology assessment is included. Author (GRA)

N73-22941*# George Washington Univ., Washington, D.C. Program of Policy Studies in Science and Technology.
TECHNOLOGY AND PUBLIC POLICY: THE PROCESS OF TECHNOLOGY ASSESSMENT IN THE FEDERAL GOVERNMENT. VOLUME 2: APPENDICES
Vary T. Coates Jul. 1972 263 p refs 3 Vol.
(Grants NGL-09-010-030; NSF GI-30422)
(NASA-CR-131847; PB-211454) Avail: NTIS HC $15.25 CSCL 05A

Volume 2 (Appendices) includes: Descriptions of 86 offices within federal executive agencies, with brief details of mission and responsibilities, technology assessment activities, future research, staff, special techniques used, coordination with other offices and agencies, effect on workload of Nat. Environmental Policy Act of 1969; Data sheets describing 97 illustrative examples of federal technology assessment and closely related research; List of interviews; Questions used in interviewing. Author (GRA)

N73-22942# Army Foreign Science and Technology Center, Charlottesville, Va.
ANTIAIRCRAFT DEFENSE HERALD, NO. 8, AUGUST 1972
13 Feb. 1973 194 p refs Transl. into ENGLISH of Vestn. Protivovozdushnoy Oborony (Moscow), no. 8, Aug. 1972
(AD-755679; FSTC-HT-23-1256-73) Avail: NTIS CSCL 15/3

Articles have been written by USSR military personnel in reference to military training, aviation, foreign military information, discipline, combat readiness, and trouble shooting. GRA

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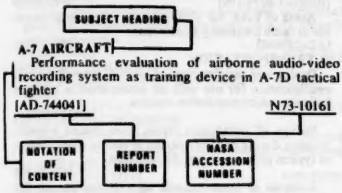

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55-Nitinol—The Alloy With a Memory: Its Physical Metallurgy, Properties, and Applications (NASA SP–5110)

By C. M. JACKSON, H. J. WAGNER, AND R. J. WASILEWSKI

A technology utilization report on a series of nickel-titanium alloys which possess shape "memories." Components made of these materials that are altered in shape under proper conditions will return to predetermined shapes when they are heated. This report also includes discussions of the physical metallurgy and the mechanical, physical, and chemical properties of 55-Nitinol; procedures for melting and processing the material; and a summary of applications that may apply to these unique alloys. *Paperbound.* 92 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $1.00.

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